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PROCEEDINGS

OF

The American Association

FOR THE

ADVANCEMENT OF SCIENCE

FIFTIETH MEETING

HELD AT

DENVER, COLO.

AUGUST, 1901

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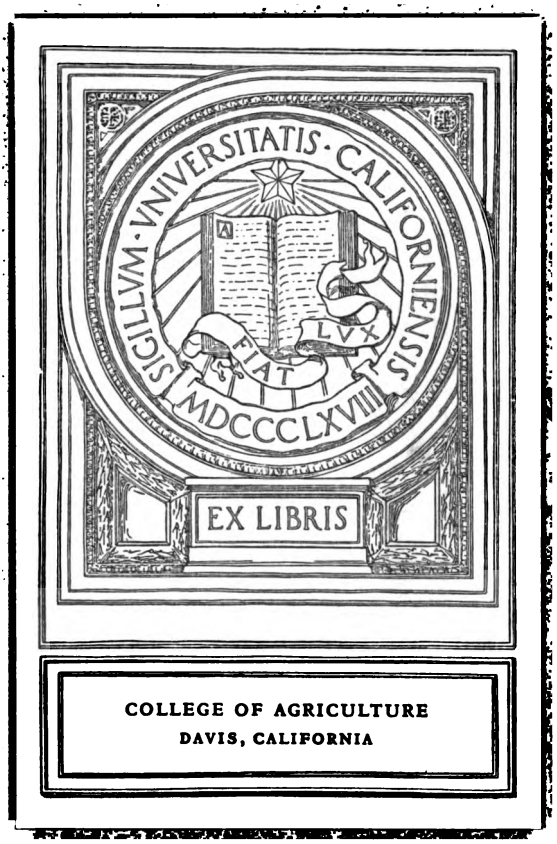

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DAVIS, CALIFORNIA

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PROCEEDINGS

OF

The American Association

FOR THE

ADVANCEMENT OF SCIENCE

FIFTIETH MEETING

HELD AT

DENVER, COLO.

AUGUST, 1901

PUBLISHED BY THE PERMANENT SECRETARY

1901

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EDITED BY

L. O. HOWARD,

Permanent Secretary.

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1901.

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Officers of the Denver Meeting.

PRESIDENT.

CHARLES SEDGWICK MINOT, Harvard University, Cambridge, Mass.

VICE PRESIDENTS.

A. **Mathematics and Astronomy**—JAMES MCMAHON, Cornell University, Ithaca, N. Y.

B. **Physics**—D. B. BRACE, University of Nebraska, Lincoln, Neb.

C. **Chemistry**—JOHN H. LONG, Northwestern University, Chicago, Ill.

D. **Mechanical Science and Engineering**—H. S. JACOBY, Cornell University, Ithaca, N. Y.

E. **Geology and Geography**—C. R. VAN HISE, University of Wisconsin, Madison, Wis.

F. **Zoology**—D. S. JORDAN, Leland Stanford, Jr., University, Stanford University, Cal.

G. **Botany**—B. T. GALLOWAY, U. S. Department of Agriculture, Washington, D. C.

H. **Anthropology**—J. WALTER FEWKES, Bureau of American Ethnology, Washington, D. C.

I. **Social and Economic Science**—JOHN HYDE, U. S. Department of Agriculture, Washington, D. C.

K. **Physiology and Experimental Medicine.**—(This new section will organize at the Denver meeting).

PERMANENT SECRETARY.

L. O. HOWARD, Cosmos Club, Washington, D. C.

GENERAL SECRETARY.

JOHN M. COULTER, University of Chicago, Chicago, Ill. (in the absence of WILLIAM HALLOCK).

SECRETARY OF THE COUNCIL.

D. T. MACDOUGAL, N. Y. Botanical Gardens, New York, N. Y.

SECRETARIES OF THE SECTIONS.

A. **Mathematics and Astronomy**—G. A. MILLER, Cornell University, Ithaca, N. Y. (in the absence of H. C. LORD).

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B. **Physics**—JOHN ZELENY, University of Minnesota, Minneapolis, Minn. (in the absence of J. O. REED).

C. **Chemistry**—WM. MCPHERSON, Ohio State University, Columbus, Ohio.

D. **Mechanical Science and Engineering**—CHARLES W. COMSTOCK, Golden, Colo. (in the absence of W. H. JAQUES).

E. **Geology and Geography**—H. B. PATTON, Golden, Colo. (in the absence of R. A. F. PENROSE).

F. **Zoology**—H. B. WARD, University of Nebraska, Lincoln, Neb.

G. **Botany**—ERNST A. BESSEY, U. S. Department of Agriculture, Washington, D. C. (in the absence of A. S. HITCHCOCK).

H. **Anthropology**—G. G. MACCURDY, Yale University, New Haven, Conn.

I. **Social and Economic Science**—R. A. PEARSON, U. S. Department of Agriculture, Washington, D. C. (in the absence of MISS C. A. BENNESON).

K. **Physiology and Experimental Medicine**—(This new section will organize at the Denver meeting).

TREASURER.

R. S. WOODWARD, Columbia University, New York, N. Y.

ASSISTANT SECRETARY.

RICHARD S. CLIFTON, West Washington, D. C.

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Vice Presidents of the Columbus Meeting.—ALEXANDER MACFARLANE, South Bethlehem; ELIHU THOMSON, Lynn; F. P. VENABLE, Chapel Hill; STORM BULL, Madison; J. F. WHITEAVES, Ottawa; S. H. GAGE, Ithaca; C. R. BARNES, Chicago; THOMAS WILSON, Washington; MARCUS BENJAMIN, Washington.

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From the Association at Large.—To hold over until successors are elected. A Fellow from each section: G. B. HALSTED, Austin; E. L. NICHOLS, Ithaca; C. S. PALMER, Boulder; C. A. WALDO, Lafayette; T. C. CHAMBERLAIN, Chicago; F. M. WEBSTER, Wooster; L. M. UNDERWOOD, Stanford; W J MCGEE, Washington; E. T. PETERS, Washington; J. MCK. CATTELL, New York.

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Local Committees of the Denver Meeting.*

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HON. JAMES B. GRANT.

HONORARY VICE-PRESIDENTS.

(See Preliminary Announcement.)

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GEN. IRVING HALE, Treasurer.
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AARON GOVE. MRS. J. B. GRANT.
JAMES F. CALLBREATH, JR.

MEMBERS AT LARGE.

(See Preliminary Announcement.)

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HON. R. R. WRIGHT, JR., Mayor of Denver, Chairman.

LADIES' RECEPTION COMMITTEE.

MRS. JAMES B. GRANT, Chairman.
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COMMITTEE ON ROOMS AND HALLS.

AARON GOVE, Chairman.

COMMITTEE ON PRINTING.

JAMES F. CALLBREATH, JR., Chairman.

*For full membership of all local committees, see the Preliminary Announcement of the Denver Meeting.

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PRESIDENT.

ASAPH HALL, Cambridge, Mass.

VICE PRESIDENTS.

A. **Mathematics and Astronomy**—G. W. HOUGH, Northwestern University, Evanston, Ill.
B. **Physics**—W. S. FRANKLIN, Lehigh University, South Bethlehem, Pa.
C. **Chemistry**—H. A. WEBER, Ohio State University, Columbus, Ohio.
D. **Mechanical Science and Engineering**—J. J. FLATHER, University of Minnesota, Minneapolis, Minn.
E. **Geology and Geography**—O. A. DERBY, São Paulo, Brazil.
F. **Zoology**—C. C. NUTTING, Iowa State University, Iowa City, Iowa.
G. **Botany**—D. H. CAMPBELL, Stanford University, Cal.
H. **Anthropology**—STEWART CULIN, University of Pennsylvania, Philadelphia, Pa.
I. **Social and Economic Science**—CARROLL D. WRIGHT, Commissioner of Labor, Washington, D. C.
K. **Physiology and Experimental Medicine**—W. H. WELCH, Johns Hopkins University, Baltimore, Md.

PERMANENT SECRETARY.

L. O. HOWARD, Cosmos Club, Washington, D. C.

GENERAL SECRETARY.

D. T. MACDOUGAL, New York Botanical Gardens, Bronx Park, New York, N. Y.

SECRETARY OF THE COUNCIL.

H. B. WARD, University of Nebraska, Lincoln, Neb.

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A. E. S. CRAWLEY, University of Pennsylvania, Philadelphia, Pa.
B. E. F. NICHOLS, Ohio State University, Columbus, Ohio.
C. F. C. PHILLIPS, Western University, Allegheny, Pa.
D. C. A. WALDO, Purdue University, Lafayette, Ind.
E. F. P. GULLIVER, St. Mark's School, Southboro, Mass.
F. C. W. STILES, U. S. Dept. of Agriculture, Washington, D. C.
G. H. VON SCHRENK, Shaw School of Botany, St. Louis, Mo.
H. H. I. SMITH, American Museum of Natural History, New York.
I. (To be elected.)
K. F. S. LEE, Columbia University, New York, N. Y.

TREASURER.

R. S. WOODWARD, Columbia University, New York, N. Y.

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From the Association at Large.—To hold over until successors are elected. A fellow from each section: G. B. HALSTED, Austin; E. L. NICHOLS, Ithaca; C. S. PALMER, Boulder; T. C. CHAMBERLAIN, Chicago; F. M. WEBSTER, Wooster; L. M. UNDERWOOD, Stanford; W J MCGEE, Washington; E. T. PETERS, Washington; J. MCK. CATTELL, New York.

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Special Committees of the Association.[1]

1. *Auditors.*

EMORY MCCLINTOCK, Morristown, and G. K. GILBERT, Washington.

2. *Committee on Indexing Chemical Literature.*

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3. *Committee on the Policy of the Association.*

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4. *Committee on Standards of Measurements.*

T. C. MENDENHALL, *Chairman*, E. W. MORLEY, E. L. NICHOLS, R. S. WOODWARD, H. S. CARHART. With power to add to its number.

5. *Committee on the Association Library.*

F. W. CLARKE, *Chairman*, A. W. BUTLER, W. L. DUDLEY, THOMAS FRENCH, JR.

6. *Committee on Anthropometric Measurements.*

J. MCK. CATTELL, W. W. NEWELL, W J MCGEE, FRANZ BOAS.

7. *Committee to Cooperate with the National Educational Association Regarding the Teaching of Science in the Secondary Schools.*

R. S. TARR, H. S. CARHART, A. S. PACKARD, C. F. MABERY, C. E. BESSEY.

8. *Committee for the Collection of Information Relative to Forestry.*

W. H. BREWER, *Chairman*, GIFFORD PINCHOT, ARNOLD HAGUE.

9. *Committee on the Quantitative Study of Biological Variation.*

FRANZ BOAS, *Chairman*, J. MCK. CATTELL, C. S. MINOT, C. H. EIGENMANN, C. B. DAVENPORT.

10. *Committee on the Protection and Preservation of Objects of Archaeological Interest.*

THOMAS WILSON, *Chairman*, F. W. PUTNAM, N. H. WINCHELL, G. K. GILBERT, A. W. BUTLER, GEORGE A. DORSEY.

[1] All Committees are expected to present their reports to the COUNCIL not later than the third day of the meeting. Committees sending their reports to the Permanent Secretary one month before a meeting can have them printed for use at the meeting.

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11. *Committee on the Study of Blind Vertebrates.*

THEODORE GILL, *Chairman*, A. S. PACKARD, C. O. WHITMAN, S. H. GAGE, H. C. BUMPUS, C. H. EIGENMANN.

12. *Committee on the Teaching of Anthropology in America.*

W J MCGEE, *Chairman*, G. G. MACCURDY, FRANK RUSSELL, FRANZ BOAS, W. H. HOLMES.

13. *Committee on the Relations of the Journal Science with the Association.*

SIMON NEWCOMB, *Chairman*, G. K GILBERT, J. MCK. CATTELL, THE PRESIDENT, THE PERMANENT SECRETARY.

14. *Committee on the Relations of Plants and Climate.*

WILLIAM TRELEASE, *Chairman*, D. T. MACDOUGAL, J. M. COULTER.

15. *Committee on the Atomic Weight of Thorium.*

CHARLES BASKERVILLE, *Chairman*, F. P. VENABLE, JAMES LEWIS HOWE.

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MEETINGS AND OFFICERS OF THE ASSOCIATION OF AMERICAN GEOLOGISTS AND NATURALISTS.

Meeting.	Date.	Place.	Chairman.	Secretary.	Assistant Secretary.	Treasurer.
1st	April 2, 1840,	Philadelphia,	Edw. Hitchcock,*	L. C. Beck,*		
2d	April 5, 1841,	Philadelphia,	Benj. Silliman,*	L. C. Beck,*	B. Silliman, Jr.,* C. B. Trego,*	
3d	April 25, 1842,	Boston,	S. G. Morton,*	C. T. Jackson,*	J. D. Whitney,* M. B. Williams,*	
4th	April 26, 1843,	Albany,	Henry D. Rogers,*	B. Silliman, Jr.,*		John Locke.*
5th	May 8, 1844,	Washington,	John Locke,*	B. Silliman, Jr.,* O. P. Hubbard,		Douglas Houghton.*
6th	April 30, 1845,	New Haven,	Wm. B. Rogers,*	B. Silliman, Jr.,* J. Law. Smith,*		Douglas Houghton.*
7th	Sept. 2, 1846,	New York,	C. T. Jackson,*	B. Silliman, Jr.,*		E. C. Herrick.*
8th	Sept. 20, 1847,	Boston,	Wm. B. Rogers,†*	Jeffries Wyman,*		B. Silliman, Jr.*

* Deceased.

† Professor Rogers, as chairman of this last meeting, called the first meeting of the new Association to order and presided until it was fully organized by the adoption of a constitution. As he was thus the first presiding officer of the new Association, it was directed at the Hartford meeting that his name be placed at the head of the Past Presidents of the American Association for the Advancement of Science.

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Meetings	Place	Date	Members in attendance	Number of members
1	Philadelphia	Sept. 20, 1848	?	461
2	Cambridge	Aug. 14, 1849	?	540
3	Charleston	Mar. 12, 1850	?	622
4	New Haven	Aug. 19, 1850	?	704
5	Cincinnati	May 5, 1851	87	800
6	Albany	Aug. 19, 1851	194	769
7	Cleveland	July 28, 1853	?	940
8	Washington	April 26, 1854	168	1004
9	Providence	Aug. 15, 1855	166	605
10	2nd Albany	Aug. 20, 1856	381	722
11	Montreal	Aug. 12, 1857	351	946
12	Baltimore	April 28, 1858	190	962
13	Springfield	Aug. 3, 1859	190	862
14	Newport	Aug. 1, 1860	135	644
15	Buffalo	Aug. 15, 1866	79	637
16	Burlington	Aug. 21, 1867	73	415
17	Chicago	Aug. 5, 1868	259	686
18	Salem	Aug. 18, 1869	244	511
19	Troy	Aug. 17, 1870	188	536
20	Indianapolis	Aug. 16, 1871	196	668
21	Dubuque	Aug. 15, 1872	164	610
22	Portland	Aug. 20, 1873	195	670
23	Hartford	Aug. 12, 1874	224	722
24	Detroit	Aug. 11, 1875	165	807
25	2nd Buffalo	Aug. 23, 1876	215	867
26	Nashville	Aug. 29, 1877	173	953
27	St. Louis	Aug. 21, 1878	134	962
28	Saratoga	Aug. 27, 1879	256	1030
29	Boston	Aug. 25, 1880	997	1555
30	2nd Cincinnati	Aug. 17, 1881	500	1699
31	2nd Montreal	Aug. 23, 1882	937	1922
32	Minneapolis	Aug. 15, 1883	328	2033
33	2nd Philadelphia	Sept. 3, 1884	1261*	1981
34	Ann Arbor	Aug. 26, 1885	364	1956
35	3d Buffalo	Aug. 18, 1886	445	1886
36	New York	Aug. 10, 1887	729	1956
37	2nd Cleveland	Aug. 14, 1888	342	1964
38	Toronto	Aug. 26, 1889	424	1952
39	2nd Indianapolis	Aug. 19, 1890	364	1944
40	2nd Washington	Aug. 19, 1891	653†	2054
41	Rochester	Aug. 17, 1892	456	2037
42	Madison	Aug. 17, 1893	290	1939
43	Brooklyn	Aug. 15, 1894	488	1802
44	2nd Springfield	Aug. 28, 1895	368	1913
45	4th Buffalo	Aug. 24, 1896	333	1890
46	2nd Detroit	Aug. 9, 1897	283‡	1782
47	2nd Boston	Aug. 22, 1898	903	1729
48	Columbus	Aug. 21, 1899	353	1721
49	2nd New York	June 25, 1900	434	1925
50	Denver	Aug. 24, 1901	311	2703

* Including 303 members of the British Association and 9 other foreign guests.
† Including 24 Foreign Honorary members for the meeting.
‡ Including 15 Foreign Honorary members and associates for the meeting.

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Officers of the Meetings of the Association.

[The number before the name is that of the meeting; the year of the meeting follows the name; the asterisk after a name indicates that the member is deceased.]

PRESIDENTS.

1. WM. B. ROGERS,* 1848. W. C. REDFIELD,* 1848.
2. JOSEPH HENRY,* 1849.
3. A. D. BACHE,* March meeting, 1850, in the absence of
4. JOSEPH HENRY.* August meeting, 1850. May meeting, 1851.
5.
6. LOUIS AGASSIZ,* August meeting, 1851.
   (No meeting in 1852.)
7. BENJAMIN PIERCE,* 1853.
8. JAMES D. DANA,* 1854.
9. JOHN TORREY,* 1855.
10. JAMES HALL,* 1856.
11. ALEXIS CASWELL,* 1857, in place of J. W. BAILEY,* deceased. 1858, in the absence of
12. JEFFRIES WYMAN.*
13. STEPHEN ALEXANDER,* 1859.
14. ISAAC LEA,* 1860.
   (No meetings for 1861–65.)
15. F. A. P. BARNARD,* 1866.
16. J. S. NEWBERRY,* 1867.
17. B. A. GOULD,* 1868.
18. J. W. FOSTER,* 1869.
19. T. STERRY HUNT,* 1870, in the absence of WM. CHAUVENET.*
20. ASA GRAY,* 1871.
21. J. LAWRENCE SMITH,* 1872.
22. JOSEPH LOVERING,* 1873.
23. J. L. LECONTE,* 1874.
24. J. E. HILGARD,* 1875.
25. WILLIAM B. ROGERS,* 1876.
26. SIMON NEWCOMB, 1877.
27. O. C. MARSH,* 1878.
28. G. F. BARKER, 1879.
29. LEWIS H. MORGAN,* 1880.
30. G. J. BRUSH, 1881.
31. J. W. DAWSON, 1882.
32. C. A. YOUNG, 1883.
33. J. P. LESLEY, 1884.
34. H. A. NEWTON,* 1885.
35. EDWARD S. MORSE, 1886.
36. S. P. LANGLEY, 1887.
37. J. W. POWELL, 1888.
38. T. C. MENDENHALL, 1889.
39. G. LINCOLN GOODALE, 1890.
40. ALBERT B. PRESCOTT, 1891.
41. JOSEPH LECONTE,* 1892.
42. WILLIAM HARKNESS, 1893.
43. DANIEL G. BRINTON,* 1894.
44. E. W. MORLEY, 1895.
45. EDWARD D. COPE,* 1896. THEODORE GILL, as senior vice-president acted after the death of Prof. COPE.
46. WOLCOTT GIBBS, 1897, absent. W J MCGEE, Acting President.
47. F. W. PUTNAM, 1898.
48. EDWARD ORTON,* 1899. GROVE K. GILBERT, elected by the General Committee December, 1899, to fill the vacancy caused by the death of Prof. ORTON.
49. R. S. WOODWARD, 1900.
50. C. S. MINOT, 1901.
51. ASAPH HALL, 1902.

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VICE PRESIDENTS.

There were no Vice Presidents until the 11th meeting when there was a single Vice President for each meeting. At the 24th meeting, the Association met in Sections A and B, each presided over by a Vice President. At the 31st meeting nine sections were organized, each with a Vice President as its presiding officer. In 1886, Section G (Microscopy) was given up. In 1892, Section F was divided into F, Zoology; G, Botany.

1857–1874.

11. ALEXIS CASWELL,* 1857, acted as President.
12. JOHN E. HOLBROOK,* 1858, not present.
13. EDWARD HITCHCOCK,* 1859,
14. B. A. GOULD,* 1860.
15. B. A. GOULD,* 1866, in the absence of R. W. GIBBES.
16. WOLCOTT GIBBS, 1867.
17. CHARLES WHITTLESEY,* 1868.
18. OGDEN N. ROOD, 1869.
19. T. STERRY HUNT,* 1870, acted as President.
20. G. F. BARKER, 1871.
21. ALEXANDER WINCHELL,*1872
22. A. H. WORTHEN,* 1873, not present.
23. C. S. LYMAN,* 1874.

1875–1881.

Section A.—Mathematics, Physics, and Chemistry.

24. H. A. NEWTON,* 1875.
25. C. A. YOUNG, 1876.
26. R. H. THURSTON, 1877, in the absence of E. C. PICKERING.
27. R. H. THURSTON, 1878.
28. S. P. LANGLEY, 1879.
29. ASAPH HALL, 1880.
30. WILLIAM HARKNESS, 1881, in the absence of A.M. MAYER.*

Section B.—Natural History.

24. J. W. DAWSON, 1875.
25. EDWARD S. MORSE, 1876.
26. O. C. MARSH,* 1877.
27. AUG. R. GROTE, 1878.
28. J. W. POWELL, 1879.
29. ALEXANDER AGASSIZ, 1880.
30. EDWARD T. COX, 1881, in the absence of GEORGE ENGELMANN.*

CHAIRMEN OF SUBSECTIONS, 1875–1881.

Subsection of Chemistry.

24. S. W. JOHNSON, 1875.
25. G. F. BARKER, 1876.
26. N. T. LUPTON,* 1877.
27. F. W. CLARKE, 1878.
28. F. W. CLARKE, 1879, in the absence of IRA REMSEN.
29. J. M. ORDWAY, 1880.
30. G. C. CALDWELL, 1881, in the absence of W. R. NICHOLS.*

Subsection of Microscopy.

25. R. H. WARD, 1876.
26. R. H. WARD, 1877.
27. R. H. WARD, 1878, in the absence of G. S. BLACKIE.*
28. E. W. MORLEY, 1879.
29. S. A. LATTIMORE, 1880.
30. A. B. HERVEY, 1881.

Subsection of Anthropology.

24. LEWIS H. MORGAN,* 1875.
25. LEWIS H. MORGAN,* 1876.
26. DANIEL WILSON,* 1877, not present.
27. United with Section B.
28. DANIEL WILSON,* 1879.
29. J. W. POWELL, 1880.
30. GARRICK MALLERY,* 1881.

Subsection of Entomology.

30. J. G. MORRIS,* 1881.

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VICE PRESIDENTS OF SECTIONS, 1882–

Section A.—Mathematics and Astronomy.

31. W. A. ROGERS,* 1882, in the absence of WM. HARKNESS.
32. W. A. ROGERS, 1883.
33. H. T. EDDY, 1884.
34. WM. HARKNESS, 1885, in the absence of J. M. VAN VLECK.
35. J. W. GIBBS, 1886.
36. J. R. EASTMAN, 1887, in place of W. FERREL,* resigned.
37. ORMOND STONE, 1888.
38. R. S. WOODWARD, 1889.
39. S. C. CHANDLER, 1890.
40. E. W. HYDE, 1891.
41. J. R. EASTMAN, 1892.
42. C. L. DOOLITTLE, 1893.
43. { G. C. COMSTOCK, 1894. / EDGAR FRISBY, 1894.
44. EDGAR FRISBY, 1895, in place of E. H. HOLDEN, resigned.
45. ALEX. MACFARLANE, 1896, in place of WM. E. STORY, resigned.
46. W. W. BEMAN, 1897.
47. E. E. BARNARD, 1898.
48. ALEX. MACFARLANE, 1899.
49. ASAPH HALL, JR., 1900.
50. JAMES MACMAHON, 1901.
51. G. W. HOUGH, 1902.

Section B.—Physics.

31. T. C. MENDENHALL, 1882.
32. H. A. ROWLAND, 1883.
33. J. TROWBRIDGE, 1884.
34. S. P. LANGLEY, 1885, in place of C. F. BRACKETT, resigned.
35. C. F. BRACKETT, 1886.
36. W. A. ANTHONY, 1887.
37. A. A. MICHELSON, 1888.
38. H. S. CARHART, 1889.
39. CLEVELAND ABBE, 1890.
40. F. E. NIPHER, 1891.
41. B. F. THOMAS, 1892.
42. E. L. NICHOLS, 1893.
43. WM. A. ROGERS, 1894.
44. W. LECONTE STEVENS, 1895.
45. CARL LEO MEES, 1896.
46. CARL BARUS, 1897.
47. F. P. WHITMAN, 1898.
48. ELIHU THOMSON, 1899.
49. ERNEST MERRITT, 1900.
50. D. B. BRACE, 1901.
51. W. S. FRANKLIN, 1902.

Section C.—Chemistry.

31. H. C. BOLTON, 1882.
32. E. W. MORLEY, 1883.
33. J. W. LANGLEY, 1884.
34. N. T. LUPTON,* 1885, in the absence of W. R. NICHOLS.*
35. H. W. WILEY, 1886.
36. A. B. PRESCOTT, 1887.
37. C. E. MUNROE, 1888.
38. W. L. DUDLEY, 1889.
39. R. B. WARDER, 1890.
40. R. C. KEDZIE, 1891.
41. ALFRED SPRINGER, 1892.
42. EDWARD HART, 1893.
43. T. H. NORTON, 1894.
44. WM. MCMURTRIE, 1895.
45. W. A. NOYES, 1896.
46. W. P. MASON, 1897.
47. EDGAR F. SMITH, 1898.
48. F. P. VENABLE, 1899.
49. JAS. LEWIS HOWE, 1900.
50. JOHN H. LONG, 1901.
51. H. A. WEBER, 1902.

Section D.—Mechanical Science and Engineering.

31. W. P. TROWBRIDGE,* 1882.
32. DE VOLSON WOOD, 1883, absent, but place was not filled.
33. R. H. THURSTON, 1884.
34. J. BURKITT WEBB, 1885.
35. O. CHANUTE, 1886.
36. E. B. COXE, 1887.
37. C. J. H. WOODBURY, 1888.
38. JAMES E. DENTON, 1889.
39. JAMES E. DENTON, 1890, in place of A. BEARDSLEY, absent.

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VICE PRESIDENTS OF SECTIONS, CONTINUED.

Section D.—Mechanical Science and Engineering, continued.

40. THOMAS GRAY, 1891.
41. J. B. JOHNSON, 1892.
42. S. W. ROBINSON, 1893.
43. MANSFIELD MERRIMAN, 1894.
44. WILLIAM KENT, 1895.
45. FRANK O. MARVIN, 1896.
46. JOHN GALBRAITH, 1897.
47. JOHN GALBRAITH, 1898, in the absence of M. E. COOLEY.
48. STORM BULL, 1899.
49. JOHN A. BRASHEAR, 1900.
50. H. S. JACOBY, 1901.
51. J. J. FLATHER, 1902.

Section E.—Geology and Geography.

31. E. T. COX, 1882.
32. C. H. HITCHCOCK, 1883.
33. N. H. WINCHELL, 1884.
34. EDWARD ORTON,* 1885.
35. T. C. CHAMBERLAIN, 1886.
36. G. K. GILBERT, 1887.
37. GEORGE H. COOK,* 1888.
38. CHARLES A. WHITE, 1889.
39. JOHN C. BRANNER, 1890.
40. J. J. STEVENSON, 1891.
41. H. S. WILLIAMS, 1892.
42. CHARLES D. WALCOTT, 1893.
43. SAMUEL CALVIN, 1894.
44. JED. HOTCHKISS, 1895.
45. B. K. EMERSON, 1896.
46. { I. C. WHITE, 1897. / E. W. CLAYPOLE,* 1897.
47. H. L. FAIRCHILD, 1898.
48. J. F. WHITEAVES, 1899.
49. J. F. KEMP, 1900.
50. C. R. VAN HISE, 1901.
51. O. A. DERBY, 1902.

Section F.—Biology, 1882–1892.

31. W. H. DALL, 1882.
32. W. J. BEAL, 1883.
33. E. D. COPE,* 1884.
34. T. J. BURRILL, 1885, in the absence of B. G. WILDER.
35. H. P. BOWDITCH, 1886.
36. W. G. FARLOW, 1887.
37. C. V. RILEY,* 1888.
38. GEORGE L. GOODALE, 1889.
39. C. S. MINOT, 1890.
40. J. M. COULTER, 1891.
41. S. H. GAGE, 1892.

Section F.—Zoology.

42. HENRY F. OSBORN, 1893.
43. J. A. LINTNER,* 1894, in place of S. H. SCUDDER, resigned.
44. L. O. HOWARD, 1895, in place of D. S. JORDAN, resigned.
45. THEO. GILL, 1896.
46. L. O. HOWARD, 1897, in place of G. BROWN GOODE,* deceased.
47. A. S. PACKARD, 1898.
48. S. H. GAGE, 1899.
49. C. B. DAVENPORT, 1900.
50. D. S. JORDAN, 1901.
51. C. C. NUTTING, 1902.

Section G. Microscopy, 1882–1885.

31. A. H. TUTTLE, 1882.
32. J. D. COX, 1883.
33. T. G. WORMLEY,* 1884.
34. S. H. GAGE, 1885.

(Section united with F in 1886.)

Section G.—Botany.

42. CHARLES E. BESSEY, 1893.
43. { L. M. UNDERWOOD, 1894. / C. E. BESSEY, 1894.
44. J. C. ARTHUR, 1895.
45. N. L. BRITTON, 1896.
46. G. F. ATKINSON, 1897.
47. W. G. FARLOW, 1898.
48. C. R. BARNES, 1899.
49. W. TRELEASE, 1900.
50. B. T. GALLOWAY, 1901.
51. D. H. CAMPBELL, 1902.

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VICE PRESIDENTS OF SECTIONS, CONTINUED.

Section H.—Anthropology.

31. ALEX. WINCHELL,* 1882.
32. OTIS T. MASON, 1883.
33. EDWARD S. MORSE, 1884.
34. J. OWEN DORSEY,* 1885, in the absence of W. H. DALL.
35. HORATIO HALE,* 1886.
36. D. G. BRINTON,* 1887.
37. CHARLES C. ABBOTT, 1888.
38. GARRICK MALLERY,* 1889.
39. FRANK BAKER, 1890.
40. JOSEPH JASTROW, 1891.
41. W. H. HOLMES, 1892.
42. J. OWEN DORSEY,* 1893.
43. FRANZ BOAS, 1894.
44. F. H. CUSHING, 1895.
45. ALICE C. FLETCHER, 1896.
46. W J MCGEE, 1897.
47. J. MCK. CATTELL, 1898.
48. THOMAS WILSON, 1899.
49. A. W. BUTLER, 1900.
50. J. WALTER FEWKES, 1901.
51. STEWART CULIN, 1902.

Section I.—Social and Economic Science.

31. E. B. ELLIOTT,* 1882.
32. FRANKLIN B. HOUGH,* 1883.
33. JOHN EATON,* 1884.
34. EDWARD ATKINSON, 1885.
35. JOSEPH CUMMINGS,* 1886.
36. H. E. ALVORD, 1887.
37. CHARLES W. SMILEY, 1888.
38. CHARLES S. HILL, 1889.
39. J. RICHARDS DODGE, 1890.
40. EDMUND J. JAMES, 1891.
41. L. F. WARD, 1892, in place of S. D. HORTON,* resigned.
42. WILLIAM H. BREWER, 1893.
43. HENRY FARQUHAR, 1894.
44. B. E. FERNOW, 1895.
45. W. L. LAZENBY, 1896.
46. R. T. COLBURN, 1897.
47. ARCHIBALD BLUE, 1898.
48. MARCUS BENJAMIN, 1899.
49. MARCUS BENJAMIN, 1900, in the absence of C. M. WOODWARD.
50. JOHN HYDE, 1901.
51. CARROLL D. WRIGHT, 1902.

Section K.—Physiology and Experimental Medicine.

51. W. H. WELCH, 1902.

SECRETARIES.

General Secretaries, 1848–

1. WALTER R. JOHNSON,* 1848.
2. E. N. HORSFORD,* 1849, in the absence of JEFFRIES WYMAN.*
3. L. R. GIBBS, 1850, in the absence of E. C. HERRICK.*
4. E. C. HERRICK,* 1850.
5. WM. B. ROGERS,* 1851, in the absence of E. C. HERRICK.*
6. WILLIAM B. ROGERS,* 1851.
7. S. ST. JOHN,* 1853, in the absence of J. D. DANA.*
8. J. LAWRENCE SMITH,* 1854.
9. WOLCOTT GIBBS, 1855.
10. B. A. GOULD,* 1856.
11. JOHN LECONTE,* 1857.
12. W. M. GILLESPIE,* 1858, in the absence of WM. CHAUVENET.*
13. WILLIAM CHAUVENET,* 1859.
14. JOSEPH LECONTE,* 1860.
15. ELIAS LOOMIS,* 1866, in the absence of W. P. TROWBRIDGE.*
16. C. S. LYMAN,* 1867.
17. SIMON NEWCOMB, 1868, in the absence of A. P. ROCKWELL.
18. O. C. MARSH,* 1869.
19. F. W. PUTNAM, 1870, in the absence of C. F. HARTT.*
20. F. W. PUTNAM, 1871.

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SECRETARIES, CONTINUED.

21. EDWARD S. MORSE, 1872.
22. C. A. WHITE, 1873.
23. A. C. HAMLIN, 1874.
24. S. H. SCUDDER, 1875.
25. T. C. MENDENHALL, 1876.
26. AUG. R. GROTE, 1877.
27. H. C. BOLTON, 1878.
28. H. C. BOLTON, 1879, in the absence of GEORGE LITTLE.
29. J. K. REES, 1880.
30. C. V. RILEY,* 1881.
31. WILLIAM SAUNDERS, 1882.
32. J. R. EASTMAN, 1883.
33. ALFRED SPRINGER, 1884.
34. C. S. MINOT, 1885.
35. S. G. WILLIAMS, 1886.
36. WILLIAM H. PETTEE, 1887.
37. JULIUS POHLMAN, 1888.
38. C. LEO MEES, 1889.
39. H. C. BOLTON, 1890.
40. H. W. WILEY, 1891.
41. A. W. BUTLER, 1892.
42. T. H. NORTON, 1893.
43. H. L. FAIRCHILD, 1894.
44. JAS. LEWIS HOWE, 1895.
45. CHARLES R. BARNES, 1896.
46. ASAPH HALL, JR., 1897.
47. J. MCMAHON, 1898, in place of D. S. KELLICOTT,* deceased.
48. F. BEDELL, 1899.
49. CHARLES BASKERVILLE, 1900.
50. JOHN M. COULTER, 1901, in the absence of WILLIAM HALLOCK.
51. D. T. MACDOUGAL, 1902.

Permanent Secretaries, 1851–

5–7. SPENCER F. BAIRD,* 1851–4.
8–17. JOSEPH LOVERING.* 1854–68.
18. F. W. PUTNAM, 1869, in the absence of J. LOVERING.*
19–21. JOSEPH LOVERING,* 1870–73.
22–46. F. W. PUTNAM, 1873–98.
47–53. L. O. HOWARD, 1898–1905.

Assistant General Secretaries, 1882–1887.

31. J. R. EASTMAN, 1882.
32. ALFRED SPRINGER, 1883.
33. C. S. MINOT, 1884, in the absence of E. S. HOLDEN.
34. S. G. WILLIAMS, 1885, in the absence of C. C. ABBOTT.
35. W. H. PETTEE, 1886.
36. J. C. ARTHUR, 1887.

Secretaries of the Council, 1888–

37. C. LEO MEES, 1888.
38. H. C. BOLTON, 1889.
39. H. W. WILEY, 1890.
40. A. W. BUTLER, 1891.
41. T. H. NORTON, 1892.
42. H. LEROY FAIRCHILD, 1893.
43. JAS. LEWIS HOWE, 1894.
44. CHARLES R. BARNES, 1895.
45. ASAPH HALL, JR., 1896.
46. D. S. KELLICOTT,* 1897.
47. FREDERICK BEDELL, 1898.
48. CHARLES BASKERVILLE, 1899.
49. WILLIAM HALLOCK, 1900.
50. D. T. MACDOUGAL, 1901.
51. H. B. WARD, 1902.

Secretaries of Section A.—Mathematics, Physics and Chemistry, 1875–1871.

24. { S. P. LANGLEY, 1875. / T. C. MENDENHALL, 1875.
25. A. W. WRIGHT, 1876.
26. H. C. BOLTON, 1877.
27. F. E. NIPHER, 1878.
28. J. K. REES, 1879.
29. H. B. MASON, 1880.
30. E. T. TAPPAN, 1881, in the absence of JOHN TROWBRIDGE.

Secretaries of Section B.—Natural History, 1874–1881.

24. EDWARD S. MORSE, 1875.
25. ALBERT H. TUTTLE, 1876.
26. WILLIAM H. DALL, 1877.

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SECRETARIES, CONTINUED.

27. GEORGE LITTLE, 1878.
28. WILLIAM H. DALL, 1879, in the absence of A. C. WETHERBY.
29. CHARLES V. RILEY,* 1880.
30. WILLIAM SAUNDERS, 1881.

SECRETARIES OF SUBSECTIONS, 1875–1881.

Subsection of Chemistry.

24. F. W. CLARKE, 1875.
25. H.C. BOLTON, 1876.
26. P. SCHWEITZER, 1877.
27. A. P. S. STUART, 1878.
28. W. R. NICHOLS,* 1879.
29. C. E. MUNROE, 1880.
30. ALFRED SPRINGER, 1881, in the absence of R. B. WARDER.

Subsection of Entomology.

30. B. P. MANN, 1881.

Subsection of Anthropology.

24. F. W. PUTNAM, 1875.
25. OTIS T. MASON, 1876.
26, 27. United with Section B.
28, 29, 30. J. G. HENDERSON, 1879–81.

Subsection of Microscopy.

25. E. W. MORLEY, 1876.
26. T. O. SOMMERS, JR., 1877.
27. G. J. ENGELMANN, 1878.
28, 29. A. B. HERVEY, 1879–80.
30. W. H. SEAMAN, 1881, in the absence of S. P. SHARPLES.

SECRETARIES OF THE SECTIONS, 1882–

Section A.—Mathematics and Astronomy.

31. H. T. EDDY, 1882.
32. G. W. HOUGH, 1883, in the absence of W. W. JOHNSON.
33. G. W. HOUGH, 1884.
34. E. W. HYDE, 1885.
35. S. C. CHANDLER, 1886.
36. H. M. PAUL, 1887.
37. C. C. DOOLITTLE, 1888.
38. G. C. COMSTOCK, 1889.
39. W. W. BEMAN, 1890.
40. F. H. BIGELOW, 1891.
41. WINSLOW UPTON, 1892.
42. C. A. WALDO, 1893, in the absence of A. W. PHILLIPS.
43. J. C. KERSHNER, 1894, in place of W. W. BEMAN, resigned.
44. ASAPH HALL, JR., 1895, in place of E. H. MOORE, resigned.
45. EDWIN B. FROST, 1896.
46. JAMES MCMAHON, 1897.
47. WINSLOW UPTON, 1898, in place of ALEXANDER ZIWET, resigned.
48. JOHN F. HAYFORD, 1899.
49. W. M. STRONG, 1900.
50. G. A. MILLER, 1901, in place of H. C. LORD, resigned.
51. E. S. CRAWLEY, 1902.

Section B.—Physics.

31. C. S. HASTINGS, 1882.
32. F. E. NIPHER, 1883, in the absence of C. K. WEAD.
33. N. D. C. HODGES, 1884.
34. B. F. THOMAS, 1885, in place of A. A. MICHELSON, resigned.
35. H. S. CARHART, 1886.
36. C. LEO MEES, 1887.
37. ALEX. MACFARLANE, 1888.
38. E. L. NICHOLS, 1889.
39. E. M. AVERY, 1890.
40. ALEX. MACFARLANE, 1891.
41. BROWN AYRES, 1892.
42. W. LECONTE STEVENS, 1893.
43. B. W. SNOW, 1894.
44. E. MERRITT, 1895.
45. FRANK P. WHITMAN, 1896.
46. FREDERICK BEDELL, 1897.

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SECRETARIES OF THE SECTIONS, CONTINUED.

47. W. S. FRANKLIN, 1898, in place of E. B. ROSA, resigned.
48. WILLIAM HALLOCK, 1899.
49. R. A. FESSENDEN, 1900.
50. JOHN ZELENY, 1901, in place of J. O. REED, resigned.
51. E. F. NICHOLS, 1902.

Section C.—Chemistry.

31. ALFRED SPRINGER, 1882.
32. J. W. LANGLEY, 1883. W. MCMURTRIE, 1883.
33. H. CARMICHAEL, 1884, in the absence of R. B. WARDER.
34. F. P. DUNNINGTON, 1885.
35. W. MCMURTRIE, 1886.
36. C. F. MABERY, 1887.
37. W. L. DUDLEY, 1888.
38. EDWARD HART, 1889.
39. W. A. NOYES, 1890.
40. T. H. NORTON, 1891.
41. JAS. LEWIS HOWE, 1892.
42. H. N. STOKES, 1893, in the absence of J. U. NEF.
43. MORRIS LOEB, 1894, in place of S. M. BABCOCK, resigned.
44. W. P. MASON, 1895. W. O. ATWATER, 1895.
45. FRANK P. VENABLE, 1896.
46. P. C. FREER, 1897.
47. C. BASKERVILLE, 1898.
48. H. A. WEBER, 1899.
49. A. A. NOYES, 1900.
50. W. MCPHERSON, 1901.
51. F. C. PHILLIPS, 1902.

Section D.—Mechanical Science and Engineering.

31. J. BURKITT WEBB, 1882, in the absence of C. B. DUDLEY.
32. J. BURKITT WEBB, 1883, *pro tempore*.
33. J. BURKITT WEBB, 1884.
34. C. J. H. WOODBURY, 1885.
35. WILLIAM KENT, 1886.
36. G. M. BOND, 1887.
37. ARTHUR BEARDSLEY, 1888.
38. W. B. WARNER, 1889.
39. THOMAS GRAY, 1890.
40. WILLIAM KENT, 1891.
41. O. H. LANDRETH, 1892.
42. D. S. JACOBUS, 1893.
43. JOHN H. KINEALY, 1894.
44. H. S. JACOBY, 1895.
45. JOHN GALBRAITH, 1896.
46. JOHN J. FLATHER, 1897.
47. W. S. ALDRICH, 1898.
48. J. M. PORTER, 1899.
49. W. T. MAGRUDER, 1900.
50. C. W. COMSTOCK, 1901, in the absence of W. H. JAQUES.
51. C. A. WALDO, 1902.

Section E.—Geology and Geography.

31. H. S. WILLIAMS, 1882, in the absence of C. E. DUTTON.
32. A. A. JULIEN, 1883.
33. E. A. SMITH, 1884.
34. G. K. GILBERT, 1885, in the absence of H. C. LEWIS.*
35. E. W. CLAYPOLE,* 1886.
36. W. M. DAVIS, 1887, in the absence of T. B. COMSTOCK.
37. JOHN C. BRANNER, 1888.
38. JOHN C. BRANNER, 1889.
39. SAMUEL CALVIN, 1890.
40. W J MCGEE, 1891.
41. R. D. SALISBURY, 1892.
42. W. H. HOBBS,* 1893, in place of R. T. HILL, resigned.
43. JED. HOTCHKISS,* 1894, in place of W. M. DAVIS, resigned.
44. J. PERRIN SMITH, 1895.
45. W. N. RICE, 1896, in place of A. C. GILL, resigned.
46. C. H. SMITH, JR., 1897.
47. WARREN UPHAM, 1898.
48. ARTHUR HOLLICK, 1899.
49. J. A. HOLMES, 1900.

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SECRETARIES OF THE SECTIONS, CONTINUED.

50. H. B. PATTON, 1901, in the absence of R. A. F. PENROSE.
51. F. P. GULLIVER, 1902.

Section F.—Biology, 1882–1892.

31. WILLIAM OSLER, 1882, in the absence of C. S. MINOT.
32. S. A. FORBES, 1883.
33. C. E. BESSEY, 1884.
34. J. A. LINTNER,* 1885, in place of C. H. FERNALD, resigned.
35. J. C. ARTHUR, 1886.
36. J. H. COMSTOCK, 1887.
37. B. E. FERNOW, 1888.
38. A. W. BUTLER, 1889.
39. J. M. COULTER, 1890.
40. A. J. COOK, 1891.
41. D. B. HALSTEAD, 1892.

Section F.—Zoology.

42. L. O. HOWARD, 1893.
43. JOHN B. SMITH, 1894, in place of WM. LIBBY, JR., resigned.
44. C. W. HARGITT, 1895, in place of S. A. FORBES, resigned.
45. D. S. KELLICOTT,* 1896.
46. C. C. NUTTING, 1897.
47. R. T. JACKSON, 1898, in place of C. W. STILES, resigned.
48. C. L. MARLATT, 1899, in place of F. W. TRUE, resigned.
49. C. H. EIGENMANN, 1900.
50. H. B. WARD, 1901.
51. C. W. STILES, 1902.

Section G.—Microscopy, 1882–1885.

31. ROBERT BROWN, JR., 1882.
32. CARL SEILER, 1883.
33. ROMYN HITCHCOCK, 1884.
34. W. H. WALMSLEY, 1885.

Section G.—Botany.

42. B. T. GALLOWAY, 1893, in the absence of F. V. COVILLE.
43. CHARLES R. BARNES, 1894.
44. { B. T. GALLOWAY, 1895. M. B. WAITE, 1895.
45. GEORGE F. ATKINSON, 1896.
46. F. C. NEWCOMBE, 1897.
47. ERWIN F. SMITH, 1898.
48. W. A. KELLERMAN, 1899.
49. D. T. MACDOUGAL, 1900.
50. ERNST A. BESSEY, 1901, in the absence of A. S. HITCHCOCK.
51. H. VON SCHRENK, 1902.

Section H.—Anthropology.

31. OTIS T. MASON, 1882.
32. G. H. PERKINS, 1883.
33. G. H. PERKINS, 1884, in the absence of W. H. HOLMES.
34. ERMINNIE A. SMITH,* 1885.
35. A. W. BUTLER, 1886.
36. CHARLES C. ABBOTT, 1887, in the absence of F. W. LANGDON.
37. FRANK BAKER, 1888.
38. W. M. BEAUCHAMP, 1889.
39. JOSEPH JASTROW, 1890.
40. W. H. HOLMES, 1891.
41. W. M. BEAUCHAMP, 1892, in place of S. CULIN, resigned.
42. WARREN K. MOOREHEAD, 1893
43. A. F. CHAMBERLIN, 1894.
44. { STEWART CULIN and W. W. TOOKER, 1895, in place of ANITA N. MCGEE, resigned.
45. G. H. PERKINS, 1896, in place of J. G. BOURKE,* deceased.
46. ANITA N. MCGEE, 1897, in place of HARLAN I. SMITH, resigned.
47. MARSHALL H. SAVILLE, 1898.
48. E. W. SCRIPTURE, 1899, in place of GEORGE A. DORSEY, resigned.
49. FRANK RUSSELL, 1900.
50. G. G. MACCURDY, 1901.
51. H. I. SMITH, 1902.

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SECRETARIES OF THE SECTIONS, CONTINUED.

Section I.—Social and Economic Science.

31. { FRANKLIN B. HOUGH,* 1882.
    { J. RICHARDS DODGE, 1882.
32. JOSEPH CUMMINGS,* 1883.
33. CHARLES W. SMILEY, 1884.
34. CHAS. W. SMILEY, 1885, in the absence of J. W. CHICKERING.
35. H. E. ALVORD, 1886.
36. W. R. LAZENBY, 1887.
37. CHARLES S. HILL, 1888.
38. J. RICHARDS DODGE, 1889.
39. B. E. FERNOW, 1890.
40. B. E. FERNOW, 1891.
41. HENRY FARQUHAR, 1892, in place of L. F. WARD, made Vice President.
42. NELLIE S. KEDZIE, 1893.
43. MANLEY MILES, 1894.
44. W. R. LAZENBY, 1895, in place of E. A. ROSS, resigned.
45. R. T. COLBURN, 1896.
46. ARCHIBALD BLUE, 1897.
47. MARCUS BENJAMIN, 1898.
48. CALVIN M. WOODWARD, 1899.
49. H. T. NEWCOMB, 1900.
50. R. A. PEARSON, 1901, in place of CORA A. BENNESON, resigned.
51. ——— ———, 1902.

Section K.—Physiology and Experimental Medicine.

51. F. S. LEE, 1902.

TREASURERS.

1. JEFFRIES WYMAN,* 1848.
2. A. L. ELWYN,* 1849.
3. ST. J. RAVENEL,* 1850, in the absence of A. L. ELWYN.*
4. A. L. ELWYN,* 1850.
5. SPENCER F. BAIRD,* 1851, in the absence of A. L. ELWYN.*

6–7. A. L. ELWYN,* 1851–53.

8. J. L. LECONTE,* 1854, in the absence of A. L. ELWYN.*

9–19. A. L. ELWYN,* 1855–1870.

20–30. WILLIAM S. VAUX,* 1871–1881.

32–42. WILLIAM LILLY,* 1882–93.

43–49. R. S. WOODWARD, 1894–1900.

50–54. R. S. WOODWARD, 1901–1904.

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Commonwealth of Massachusetts.

In the Year One Thousand Eight Hundred and Seventy-four.

AN ACT

TO INCORPORATE THE "AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE."

Be it enacted by the Senate and House of Representatives, in General Court assembled, and by the authority of the same, as follows:

SECTION 1. Joseph Henry of Washington, Benjamin Pierce of Cambridge, James D. Dana of New Haven, James Hall of Albany, Alexis Caswell of Providence, Stephen Alexander of Princeton, Isaac Lea of Philadelphia, F. A. P. Barnard of New York, John S. Newberry of Cleveland, B. A. Gould of Cambridge, T. Sterry Hunt of Boston, Asa Gray of Cambridge, J. Lawrence Smith of Louisville, Joseph Lovering of Cambridge, and John LeConte of Philadelphia, their associates, the officers and members of the Association, known as the "American Association for the Advancement of Science," and their successors, are hereby made a corporation by the name of the "American Association for the Advancement of Science," for the purpose of receiving, purchasing, holding, and conveying real and personal property, which it now is, or hereafter may be, possessed of, with all the powers and privileges, and subject to the restrictions, duties and liabilities set forth in the general laws which now or hereafter may be in force and applicable to such corporations.

SECTION 2. Said corporation may have and hold by purchase, grant, gift, or otherwise, real estate not exceeding one hundred thousand dollars in value, and personal estate of the value of two hundred and fifty thousand dollars.

SECTION 3. Any two of the corporators above named are hereby authorized to call the first meeting of the said corporation in the month of August next ensuing, by notice thereof "by mail," to each member of the said Association.

SECTION 4. This act shall take effect upon its passage.

HOUSE OF REPRESENTATIVES, March 10, 1874.
Passed to be enacted,
JOHN E. SANFORD, *Speaker.*

IN SENATE, March 17, 1874.
Passed to be enacted,
GEO. B. LORING, *President.*

March 19, 1874.
Approved,
W. B. WASHBURN.

SECRETARY'S DEPARTMENT,
Boston, April 3, 1874.
A true copy, Attest:
DAVID PULSIFER,
Deputy Secretary of the Commonwealth.

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CONSTITUTION

OF THE

AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE.

Incorporated by Act of the General Court of the Commonwealth of Massachusetts.

OBJECTS.

ARTICLE I. The objects of the Association are, by periodical and migratory meetings, to promote intercourse between those who are cultivating science in different parts of America, to give a stronger and more general impulse and more systematic direction to scientific research, and to procure for the labors of scientific men, increased facilities and a wider usefulness.

MEMBERSHIP.

ART. 2. The Association shall consist of members, fellows, patrons, corresponding members and honorary fellows.

MEMBERS.

ART. 3. Any person may become a member of the Association upon recommendation in writing by two members or fellows, and election by the Council. Any incorporated scientific society or institution, or any public or incorporated library, may be enrolled as a member of the Association by vote of the Council by payment of the initiation fee; such society, institution, or library may be represented by either the President, Curator, Director, or Librarian presenting proper credentials at any meeting of the Association for which the assessment has been paid.

ASSOCIATES.

Associates for any single meeting shall be admitted on the payment of three dollars, such associates to have all the privileges of the meeting, except reading papers and voting.

Members of scientific societies whose meetings are contemporaneous with, or immediately subsequent to, that of the Association and which are recognized by vote of the Council as 'Affiliated Societies,' may become associate members for that meeting on the payment of three dollars.

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They shall be entitled to all the privileges of membership except voting or appointment to office, but their names shall not appear in the list of members printed in the annual report.

FOREIGN ASSOCIATES.

Any member or fellow of any national scientific or educational institution, or of any society or academy of science, of any country not in America, who may be present at any meeting of the Association shall, on presenting the proper credentials, be enrolled without fee as a Foreign Associate, and shall be entitled to all the privileges of the meeting except voting on matters of business.

FELLOWS.

ART. 4. Fellows shall be elected by the Council from such of the members as are professionally engaged in science, or have, by their labors, aided in advancing science. The election of fellows shall be by ballot and a majority vote of the members of the Council at a designated meeting of the Council.

PATRONS.

ART. 5. Any person paying to the Association the sum of one thousand dollars shall be classed as a patron, and shall be entitled to all the privileges of a member and to all its publications.

HONORARY FELLOWS AND CORRESPONDING MEMBERS.

ART. 6. Honorary fellows of the Association, not exceeding three for each section, may be elected, the nominations to be made by the Council and approved by ballot in the respective sections before election by ballot in General Session. Honorary fellows shall be entitled to all the privileges of fellows and shall be exempt from all fees and assessments, and entitled to all publications of the Association issued after the date of their election. Corresponding members shall consist of such scientists not residing in America as may be elected by the council, and their number shall be limited to fifty. Corresponding members shall be entitled to all the privileges of members and to the annual volumes of Proceedings published subsequent to their election.

SUSPENSIONS.

ART. 7. The name of any member or fellow two years in arrears for annual dues shall be erased from the list of the Association, provided, that two notices of indebtedness, at an interval of at least three months,

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shall have been given; and no such person shall be restored until he has paid his arrearages or has been reelected. The Council shall have power to exclude from the Association any member or fellow, on satisfactory evidence that said member or fellow is an improper person to be connected with the Association, or has in the estimation of the Council made improper use of his membership or fellowship.

OFFICERS.

ART. 8. No member or fellow shall take part in the organization of, or hold office in, more than one section at any one meeting.

ART. 9. The officers of the Association shall be elected by ballot by the General Committee from the fellows, and shall consist of a President, a Vice President from each section, a Permanent Secretary, a General Secretary, a Secretary of the Council, a Treasurer, and a Secretary of each Section; these, with the exception of the Permanent Secretary and the Treasurer, shall be elected at each meeting for the following one, and, with the exception of the Treasurer and the Permanent Secretary, shall not be reeligible for the next two meetings. The term of office of the Permanent Secretary and of the Treasurer shall be five years.

PRESIDENT.

ART. 10. The President, or, in his absence, the senior Vice President present, shall preside at all General Sessions of the Association and at all meetings of the Council. It shall also be the duty of the President to give an address at a General Session of the Association at the meeting following that over which he presided.

VICE-PRESIDENTS.

ART. 11. The Vice Presidents shall be chairmen of their respective Sections, and of their Sectional Committees, and it shall be part of their duty to give an address, each before his own section, at such time as the council shall determine at the meeting subsequent to that at which he presides. The Vice Presidents may appoint temporary Chairmen to preside over the sessions of their sections, but shall not delegate their other duties. The Vice Presidents shall have seniority in order of their continuous membership in the Association.

GENERAL SECRETARY.

ART. 12. The General Secretary shall be the Secretary of all General Sessions of the Association, and shall keep a record of the business of these sessions. He shall receive the records from the Secretaries of the

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Sections, which, after examination, he shall transmit with his own records to the Permanent Secretary within two weeks after the adjournment of the meeting.

SECRETARY OF THE COUNCIL.

ART. 13. The Secretary of the Council shall keep the records of the Council. He shall give to the Secretary of each Section the titles of papers assigned to it by the Council. He shall receive proposals for membership and bring them before the Council.

PERMANENT SECRETARY.

ART. 14. The Permanent Secretary shall be the executive officer of the Association under the direction of the Council. He shall attend to all business not specially referred to committees nor otherwise constitutionally provided for. He shall keep an account of all business that he has transacted for the Association, and make annually a general report for publication in the annual volume of Proceedings. He shall attend to the printing and distribution of the annual volume of Proceedings, and all other printing ordered by the Association. He shall issue a circular of information to members and fellows at least three months before each meeting, and shall, in connection with the Local Committee, make all necessary arrangements for the meetings of the Association. He shall provide the Secretaries of the Association with such books and stationery as may be required for their records and business, and shall provide members and fellows with such blank forms as may be required for facilitating the business of the Association. He shall collect all assessments and admission fees, and notify members and fellows of their election, and of any arrearages. He shall receive, and bring before the Council, the titles and abstracts of papers proposed to be read before the Association. He shall keep an account of all receipts and expenditures of the Association, and report the same annually at the first meeting of the Council, and shall pay over to the Treasurer such unexpended funds as the Council may direct. He shall receive and hold in trust for the Association all books, pamphlets, and manuscripts belonging to the Association, and allow the use of the same under the provisions of the Constitution and the orders of the Council. He shall receive all communications addressed to the Association during the intervals between meetings, and properly attend to the same. He shall at each meeting report the names of fellows and members who have died since the preceding meeting. He shall be allowed a salary which shall be determined by the

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Council, and may employ one or more clerks at such compensation as may be agreed upon by the Council.

TREASURER.

ART. 15. The Treasurer shall invest the funds received by him in such securities as may be directed by the Council. He shall annually present to the Council an account of the funds in his charge. No expenditure of the principal in the hands of the Treasurer shall be made without a unanimous vote of the Council, and no expenditure of the income received by the Treasurer shall be made without a two-thirds vote of the Council. The Treasurer shall give bonds for the faithful performance of his duty in such manner and sum as the Council shall from time to time direct.

SECRETARIES OF THE SECTIONS.

ART. 16. The Secretaries of the Sections shall keep the records of their respective sections, and, at the close of the meeting, give the same, including the records of subsections, to the General Secretary. They shall also be the Secretaries of the Sectional Committees. The Secretaries shall have seniority in order of their continuous membership in the Association.

VACANCIES.

ART. 17. In case of a vacancy in the office of President, the senior Vice President shall preside, as provided in Article 10, until the General Committee can be assembled and the vacancy filled by election. Vacancies in the offices of Vice President, Permanent Secretary, Secretary of the Council, Secretaries of the Sections, and Treasurer, shall be filled by the Council by ballot.

COUNCIL.

ART. 18. The Council shall consist of the Past Presidents, and the Vice Presidents of the last two meetings, together with the President, the Vice Presidents, the Permanent Secretary, the General Secretary, the Secretary of the Council, the Secretaries of the Sections, and the Treasurer of the current meeting, of one fellow elected from each Section by ballot on the first day of its meeting, of one fellow elected by each affiliated society, and one additional fellow from each affiliated society having more than twenty-five members who are fellows of the Association. The members present at any regularly called meeting of the Council, provided there are at least five, shall form a quorum for the transaction of business. The Council

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shall meet on the day preceding each annual meeting of the Association, and arrange the program for the first day of the sessions. The time and place of this first meeting shall be designated by the Permanent Secretary. Unless otherwise agreed upon, regular meetings of the Council shall be held in the Council room at 9 o'clock, A.M., on each day of the meeting of the Association. Special meetings of the Council may be called at any time by the President. The Council shall be the board of supervision of the Association, and no business shall be transacted by the Association that has not first been referred to, or originated with, the Council. The Council shall decide which papers, discussions, and other proceedings shall be published, and have the general direction of the publications of the Association; manage the financial affairs of the Association; arrange the business and programs for General Sessions; suggest subjects for discussion, investigation or reports; elect members and fellows; and receive and act upon all invitations extended to the Association and report the same at a General Session of the Association. The Council shall receive all reports of Special Committees and decide upon them, and only such shall be read in General Session as the Council shall direct. The Council shall appoint at each meeting the following subcommittees who shall act, subject to appeal to the whole Council, until their successors are appointed at the following meeting: 1, on Papers and Reports; 2, on Members; 3, on Fellows.

GENERAL COMMITTEE.

ART. 19. The General Committee shall consist of the Council and one member or fellow elected by each of the Sections, who shall serve until their successors are elected. It shall be the duty of the committee to meet at the call of the President and elect the general officers for the following meeting of the Association. It shall also be the duty of this committee to fix the time and place for the next meeting. The Vice President and Secretary of each Section shall be recommended to the General Committee by the Sectional Committee.

MEETINGS.

ART. 20. The Association shall hold a public meeting annually, for one week or longer, at such time and place as may be determined by vote of the General Committee, and the preliminary arrangements for each meeting shall be made by the Local Committee, in conjunction with the Permanent Secretary and such other persons as the Council may designate.

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But if suitable preliminary arrangements cannot be made, the Council may afterward change the time and place appointed by the General Committee, if such change is believed advisable, by two-thirds of the members present.

ART. 21. A General Session shall be held at 10 o'clock, A.M., on the first day of the meeting, and at such other times as the Council may direct.

SECTIONS AND SUBSECTIONS.

ART. 22. The Association shall be divided into Sections, namely :—A, *Mathematics and Astronomy;* B, *Physics;* C, *Chemistry, including its application to Agriculture and the Arts;* D, *Mechanical Science and Engineering;* E, *Geology and Geography;* F, *Zoology;* G, *Botany;* H, *Anthropology;* I, *Social and Economic Science;* K, *Physiology and Experimental Medicine.* The Council shall have power to consolidate any two or more Sections temporarily, and such consolidated Sections shall be presided over by the senior Vice President and Secretary of the Sections comprising it.

SECTIONAL COMMITTEES.

ART. 23. Immediately on the organization of a Section there shall be three members or fellows elected by ballot after open nomination, who, with the Vice President and Secretary and the Vice President and Secretary of the preceding meeting, shall form its Sectional Committee. The Sectional Committees shall have power to fill vacancies in their own numbers. Meetings of the Sections shall not be held at the same time with a General Session. The Sectional Committee may invite distinguished foreign associates present at any meeting to serve as honorary members of said Committee.

ART. 24. The Sectional Committee of any Section may at its pleasure form one or more temporary Subsections, and may designate the officers thereof. The Secretary of a Subsection shall, at the close of the meeting, transmit his records to the Secretary of the Section.

ART. 25. No paper shall be read in any Section or Subsection until it has been placed on the program of the day by the Sectional Committee.

ART. 26. The Sectional Committees shall arrange and direct the business of their respective Sections. They shall prepare the daily programs and give them to the Permanent Secretary for printing at the earliest moment practicable. No titles of papers shall be entered on the daily programs except such as have passed the Committee. No change shall be

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made in the program for the day in a Section without the consent of the Sectional Committee. The Sectional Committees may refuse to place the title of any paper on the program; but every such title, with the abstract of the paper or the paper itself, must be referred to the Council with the reasons why it was refused. The Sectional Committee shall also make nominations to the General Committee for Vice President and Secretary of their respective Sections as provided for in Article 19.

ART. 27. The Sectional Committees shall examine all papers and abstracts referred to the Sections, and they shall not place on the program any paper inconsistent with the character of the Association; and to this end they have power to call for any paper, the character of which may not be sufficiently understood from the abstract submitted.

PAPERS AND COMMUNICATIONS.

ART. 28. All members and fellows must forward to the Secretary of the proper Section or to the Permanent Secretary, as early as possible, and when practicable before the convening of the Association, full titles of all the papers which they propose to present during the meeting, with a statement of the time that each will occupy in delivery, and also such abstracts of their contents as will give a general idea of their nature; and no title shall be considered by a Sectional Committee until an abstract of the paper or the paper itself has been received.

ART. 29. If the author of any paper be not ready when called upon in the regular order of the official program, the title may be dropped to the bottom of the list.

ART. 30. Whenever practicable, the proceedings and discussions at General Sessions, Sections and Subsections shall be reported by professional reporters but such reports shall not appear in print as the official reports of the Association unless revised by the Secretaries.

PRINTED PROCEEDINGS.

ART. 31. The Permanent Secretary shall have the Proceedings of each meeting printed in an octavo volume as soon after the meeting as possible, beginning one month after adjournment. Authors must prepare their papers or abstracts ready for the press, and these must be in the hands of the Secretaries of the Sections before the final adjournment of the meeting, otherwise only the titles will appear in the printed volume. The Council shall have power to order the printing of any paper by abstract or title only. Whenever practicable, proofs shall be forwarded to

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authors for revision. If any additions or substantial alterations are made by the author of a paper after its submission to the Secretary, the same shall be distinctly indicated. Illustrations must be provided for by the authors of the papers, or by a special appropriation from the Council. Immediately on publication of the volume, a copy shall be forwarded to every member and fellow of the Association who shall have paid the assessment for the meeting to which it relates, and it shall also be offered for sale by the Permanent Secretary at such price as may be determined by the Council. The Council shall also designate the institutions to which copies shall be distributed.

LOCAL COMMITTEE.

ART. 32. The Local Committee shall consist of persons interested in the objects of the Association and residing at or near the place of the proposed meeting. It is expected that the Local Committee, assisted by the officers of the Association, will make all essential arrangements for the meeting, and issue a circular giving necessary particulars, at least one month before the meeting.

LIBRARY OF THE ASSOCIATION.

ART. 33. All books and pamphlets received by the Association shall be in charge of the Permanent Secretary, who shall have a list of the same printed and shall furnish a copy to any member or fellow on application. Members and fellows who have paid their assessments in full shall be allowed to call for books and pamphlets, which shall be delivered to them at their expense, on their giving a receipt agreeing to make good any loss or damage and to return the same free of expense to the Secretary at the time specified in the receipt given. All books and pamphlets in circulation must be returned at each meeting. Not more than five books, including volumes, parts of volumes, and pamphlets, shall be held at one time by any member or fellow. Any book may be withheld from circulation by order of the Council. [The Library of the Association was, by vote of the Council in 1895, placed on deposit in the Library of the University of Cincinnati, Ohio. Members can obtain the use of books by writing to the Librarian of the University Library, Cincinnati, Ohio.]

ADMISSION FEE AND ASSESSMENTS.

ART. 34. The admission fee for members shall be five dollars in

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addition to the annual assessment. On the election of any member as a fellow an additional fee of two dollars shall be paid.

ART. 35. The annual assessment for members and fellows shall be three dollars.

ART. 36. Any member or fellow who shall pay the sum of fifty dollars to the Association, at any one time, shall become a Life Member, and as such, shall be exempt from all further assessments, and shall be entitled to the Proceedings of the Association. All money thus received shall be invested as a permanent fund, the income of which, during the life of the member, shall form a part of the general fund of the Association; but, after his death, shall be used only to assist in original research, unless otherwise directed by unanimous vote of the Council.

ART. 37. All fees and assessments must be paid to the Permanent Secretary, who shall give proper receipts for the same.

ACCOUNTS.

ART. 38. The accounts of the Permanent Secretary and of the Treasurer shall be audited annually, by Auditors appointed by the Council.

ALTERATIONS OF THE CONSTITUTION.

ART. 39. No part of this Constitution shall be amended or annulled, without the concurrence of three-fourths of the members and fellows present in General Session, after notice given at a General Session of a preceding meeting of the Association.

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MEMBERS AND FELLOWS

OF THE

AMERICAN ASSOCIATION

FOR THE

ADVANCEMENT OF SCIENCE.*

SURVIVING FOUNDERS.

[At the Brooklyn Meeting, 1894, a resolution was unanimously adopted by which all the surviving founders of the Association who have maintained an interest in science were made Honorary Life Members of the Association in recognition of their pioneer work in American Science.]

ABBOT, SAMUEL L., Boston, Mass.
BOYÉ, MARTIN H., Coopersburg, Pa.
GIBBS, WOLCOTT, Newport, R. I.

PATRONS.

[Persons contributing one thousand dollars or more to the Association are classed as Patrons, and are entitled to the privileges of members and to the publications. The names of Patrons are to remain permanently on the list.]

THOMPSON, MRS. ELIZABETH, Stamford, Conn. (22). (Died July, 1899.)
LILLY, GEN. WILLIAM, Mauch Chunk, Pa. (28). (Died Dec. 1, 1893.)
HERRMAN, MRS. ESTHER, 59 West 56th St., New York, N. Y. (29).
MCMILLIN, EMERSON, 40 Wall St., New York, N. Y. (37).

HONORARY FELLOWS.

[See ARTICLE VI of the Constitution.]

*ROGERS, PROF. WILLIAM B., Boston, Mass. (1). 1881. (Born Dec. 7, 1804. Died May 30, 1882.) **B E**

*CHEVREUL, MICHEL EUGÈNE, Paris, France. (35). 1886. (Born Aug. 31, 1786. Died April 9, 1889.) **C**

*GENTH, DR. F. A., Philadelphia, Pa. (24). 1888. (Born May 17, 1820. Died Feb. 2, 1892.) **C E**

*HALL, PROF. JAMES, Albany, N. Y. (1). 1890. (Born in 1811. Died Aug. 7, 1898.)

*GOULD, DR. BENJAMIN APTHORP, Cambridge, Mass. (2). 1895. (Born Sept. 27, 1824. Died Nov. 26, 1896.) **A B**

* Corrected to December 31, 1901.

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*LEUCKART, PROF. RUDOLF. (44). 1895. (Born in Helmstedt, Braunschweig, Germany, Oct. 7, 1823. Died in Leipzig, Feb. 7, 1898.) F

*GIBBS, PROF. WOLCOTT, Newport, R. I. (1.) 1896. B C

*WARINGTON, ROBERT, F. R. S., Rothamsted, Harpenden, England. (40). 1899. C

MEMBERS AND FELLOWS.

The names designated by an asterisk (*) are those of Fellows. (See ARTICLE IV of the Constitution.) The number in parenthesis indicates the meeting at which the Member joined the Association; the date following is the year when made a Fellow; the black letters at end of line are those of the sections to which the Member or Fellow belongs. When the name is given in small capitals, it designates that the Member or Fellow is also a Life Member. Any Member or Fellow may become a Life Member by the payment of fifty dollars. The income of the money derived from a life membership is used for the general purposes of the Association during the life of the Member; afterwards it is to be used to aid in original research. Life Members are exempt from the annual assessment, and are entitled to the publications. The names of Life Members are printed in small capitals in the regular list of Members and Fellows.

The constitution requires that the names of all Members two years in arrears shall be omitted from the list, but their names will be restored on payment of arrearages. Members not in arrears are entitled to the publications of the Association, including the journal *Science*.

*Abbe, Prof. Cleveland, Meteorologist, Weather Bureau, U. S. Dep't. Agriculture, Washington, D. C. (16). 1874. A B

*Abbe, Cleveland, Jr., 2017 I St., N. W., Washington, D. C. (44). 1899. E

*Abbe, Dr. Robert, 13 W. 50th St., New York, N. Y. (36). 1892.

Abbot, Francis Ellingwood, Ph.D., 43 Larch Road, Cambridge, Mass. (50). I

*ABBOT, DR. SAMUEL L., 90 Mt. Vernon St., Boston, Mass. (1). 1898

Abbott, Charles G., Smithsonian Institution, Washington, D. C. (49). B

Abbott, Frank L., Professor of Physical Science, State Normal School, Greeley, Colo. (50). B E

Abel, John J., Professor of Pharmacology, Johns Hopkins University, Baltimore, Md. (51). C

*Abert, S. Thayer, Metropolitan Club, Washington, D. C. (30). 1891. A B E

Abraham, Abraham, Brooklyn, N. Y. (43).

Acheson, Edward Goodrich, President of the International Acheson Graphite Co., Niagara Falls, N. Y. (50). C

Adams, Comfort A., 13 Farrar St., Cambridge, Mass. (47).

Adams, C. C., University of Chicago, Chicago, Ill. (50). F

Adams, C. E., M.D., 29 West Broadway, Bangor, Me. (43). F

Adams, Edward Dean, 35 Wall St., New York, N. Y. (49.)

Adams, Ernest Kempton, 455 Madison Ave., New York, N.Y. (50). D E

Adams, Frederick C., Classical High School, Providence, R.I. (50). B C

Adler, I., M.D., 12 E. 60th St., New York, N. Y. (49).

*Adriance, John S., 105 E. 39th St., New York, N. Y. (39). 1895. C

Albree, Chester B., Mechanical Engineer, 14-30 Market St., Allegheny, Pa. (50). D

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*Alden, John, Pacific Mills, Lawrence, Mass. (36). 1898.
Alderson, Victor C., Dean of the Technical College, Armour Institute of Technology, Chicago, Ill. (50). D
Aldis, Owen F., 230 Monadnock Block, Chicago, Ill. (41). H
*Aldrich, Wm. S., Director, Thomas S. Clarkson Memorial School of Technology, Potsdam, N. Y. (43). 1897. D
Alexander, Chas. Anderson, M. E., 10 Vine St., Batavia, N. Y. (50). D
Alexander, Curtis, Mining Engineer, Spearfish, South Dakota. (50). E
Alexander, George E., Chemist and Mining Engineer, 1736 Champa St., Denver, Colo. (50). C D
Alexander, Harry, E. E., M.E., 18 and 20 W. 34th St., New York, N. Y. (50). D
Aley, Robert J., Indiana Univ., Bloomington, Ind. (49).
Alford, William V., Garrettsville, Ohio. (48). E H
Allan, Chas. F., Newburgh, N. Y. (50). B E
Allderdice, Wm. H., Lieutenant U. S. Navy, Navy Dep't, Washington, D. C. (33). D
Alleman, Gellert, Ph.D., Instructor in Chemistry, Washington University, St. Louis, Mo. (50). C
Allen, C. L., Floral Park, N. Y. (49).
Allen, Frank, 315 Dryden Road, Ithaca, N. Y. (49). B
Allen, J. M., Hartford, Conn. (22). D
Allen, John Robins, 18 S. Ingalls St., Ann Arbor, Mich. (45). B D
Allen, Richard H., Chatham, N. J. (49).
*Allen, Dr. T. F., 3 E. 48th St., New York, N. Y. (35). 1887. G
Allen, Walter S., 34 S. Sixth St., New Bedford, Mass. (39). C I
Allison, Hendery, M.D., 149 Richmond Terrace, Port Richmond, N. Y. (50). K
*Almy, John E., Ph.D., Instructor in Physics, University of Nebraska, Lincoln, Neb. (50). 1901. B
Alpers, Wm. C., 45 West 31st St., New York, N. Y. (50). I
Alsop, E. B., 541 Wood St., Pittsburg, Pa. (50). D
Alspach, E. F., 455 West Sixth Ave., Columbus, O. (48). H
*Alvord, Maj. Henry E., U. S. Dept. Agriculture, Washington, D. C. (29). 1882. I
*Alwood, Prof. Wm. B., Agricultural and Mechanical College and Experiment Station, Blacksburg, Va. (39). 1891. F
Ames, Oakes, Assistant Director of the Botanic Garden of Harvard University, North Easton, Mass. (50). G
Ammons, Miss Theodosia G., Professor of Domestic Science, State Agricultural College, Fort Collins, Colo. (50). I
Amundson, John A., 146 Broadway, New York, N. Y. (49).
Anderson, A. J. C., 127 Water St., New York, N. Y. (49).
*Anderson, Alexander P., N. Y. Botanical Garden, Bronx Park, New York, N. Y. (45). 1899. G

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Anderson, Prof. Douglas S., Tulane Univ., New Orleans, La. (49). **B D**
Anderson, Frank, E.M., 255 Second East St., Salt Lake City, Utah. (50). **D E**
Anderson, Frank P., Epworth, Iowa. (46).
Anderson, J. Hartley, M.D., 4630 Fifth Ave., Pittsburg, Pa. (50). **K**
Andrews, Wm. C., Columbia Univ., New York, N. Y. (46).
Andrews, William Symes, care Gen'l Elec. Co., Schenectady, N. Y. (50). **D E**
Annear, John Brothers, Boulder, Colo. (50). **C**
Anthony, Mrs. Emilia C., Gouverneur, N. Y. (47). **G**
Anthony, Richard A., 122–124 Fifth Ave., New York, N. Y. (49).
*Anthony, Prof. Wm. A., Cooper Union, New York, N. Y. (28). 1880. **B**
*Appleton, John Howard, Professor of Chemistry, Brown University, Providence, R. I. (50). 1901. **C**
Archer George Frost, 31 Burling Slip, New York, N. Y. (50). **D**
Armstrong, Robert, M.D., Boulder, Colo. (50). **H K**
Arnold, Bion Joseph, 4128 Prairie Ave., Chicago, Ill. (50). **D**
Arnold, Mrs. Francis B., 101 W. 78th St., New York, N. Y. (49).
Arnold, Jacob H., Teacher of Natural Science, Redfield College, Redfield, South Dakota. (50). **I**
*Arthur, J. C., Lafayette, Ind. (21). 1883. **G**
Ashe, W. Willard, Consulting Forester, Raleigh, N. C. (47).
Ashley, George Hall, Professor of Biology and Geology, College of Charleston, Charleston, S. C. (51). **E**
*Ashmead, Wm. H., Department of Insects, U. S. National Museum, Washington, D. C. (40). 1892. **F**
Aspinwall, John, 290 Broadway, New York, N. Y. (49).
Atkins, Prof. Martin D., Agricultural College, Mich. (48). **B**
*Atkinson, Edward, 31 Milk St., Boston, Mass. (29). 1881. **D I**
*Atkinson, George F., Cornell University, Ithaca, N. Y. (39). 1892. **G**
Atkinson, John B., Earlington, Ky. (26). **D**
*Atwater, Prof. W. O., Wesleyan Univ., Middletown, Conn. (29). 1882. **C**
*Atwell, Charles B., 1938 Sherman Ave., Evanston, Ill. (36). 1890. **G**
*Auchincloss, Wm. S., 45 W. 20th St., New York, N. Y. (29). 1886. **A D**
*Austen, Prof. Peter T., 80 Broad St., New York, N. Y. (44). 1896. **C**
Austin, Dr. George M., Wilmington, Ohio. (48). **E F**
*Avery, Elroy M., Ph.D., LL.D., 657 Woodland Hills Ave., Cleveland, Ohio. (37). 1889. **B**
AVERY, SAMUEL P., 4 E. 38th St., New York, N. Y. (36).
Ayer, Edward Everett, 915 Old Colony Bldg., Chicago, Ill. (37). **H**
Ayer, James I., 5 Main St. Park, Malden, Mass. (50). **D**
*Ayers, Howard, President Univ. of Cincinnati, Cincinnati, Ohio. (49). 1901. **F**
Aylesworth, Barton O., President of the State Agricultural College, Fort Collins, Colo. (50). **I**

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*Ayres, Prof. Brown, Tulane University, New Orleans, La. (31). 1885. B
Ayres, Horace B., U. S. Geological Survey, Washington, D. C. (40).
*Babcock, Prof. S. Moulton, 432 Lake St., Madison, Wis. (33). 1885. C
Baekeland, Leo, M.D., Snug Rock, North Broadway, Yonkers, N. Y. (50). K
Baerecke, John F., M.D., Professor of Biology, Stetson University, DeLand, Fla. (50) F K
Bagby, J. H. C., Dept. Physical Science, Hampden-Sidney College, Hampden-Sidney, Va. (50). B
Bagg, Rufus Mather, Jr., Ph.D., High School, Brockton, Mass. (49). E
BAGGALEY, RALPH, Pittsburg, Pa. (50). D
*Bailey, E. H. S., Lawrence, Kan. (25). 1889. C E
Bailey, Marshall Henry, M.D., 47 Brattle St., Cambridge, Mass. (50). F K
*Bailey, Solon Irving, Associate Prof. Astronomy, Harvard Observatory, Cambridge, Mass. (50). 1901. A
Bain, Samuel M., Professor of Botany, University of Tennessee, Knoxville, Tenn. (50). G
Baker, A. G., Springfield, Mass. (44).
*Baker, Frank, M.D., 1728 Columbia Road, Washington, D. C. (31). 1886. F H K
Baker, Frederic, 815 Fifth Ave., New York, N. Y. (49).
Baker, James H., President of the University of Colorado, Boulder, Colo. (50).
*Baker, Marcus, U. S. Geol. Survey, Washington, D. C. (30). 1882. A
Baker, Orland Merriam, Dartmouth Terrace, Springfield, Mass. (44).
Balch, Samuel W., 41 Wall St., New York, N. Y. (43).
Baldwin, Mrs. G. H., 3 Madison Ave., Detroit, Mich. (34). H
Baldwin, Herbert B., 9–11 Franklin St., Newark, N. J. (43).
*Baldwin, Prof. J. Mark, Princeton, N. J. (46). 1898. H
*BALDWIN, HON. SIMEON E., Associate Judge of Supreme Court of Errors, New Haven, Conn. (50). 1901. I
*BALDWIN, S. PRENTISS, 736 Prospect St., Cleveland, Ohio. (47). 1900. E
Ball, Carleton R., U. S. Dep't Agriculture, Washington, D. C. (49). G
Ball, Elmer Darwin, Assistant Professor of Zoology, Agricultural College, Fort Collins, Colo. (50). F
Ball, Miss Emma L., 207 West Eighth Ave., Columbus, Ohio. (48).
Ball, Miss Helen Augusta, 43 Laurel St., Worcester, Mass. (50). F
*Ballard, Harlan H., 50 South St., Pittsfield, Mass. (31). 1891. E F
Balliet, Thomas M., Supt. of Schools, Springfield, Mass. (48). H I
Bancroft, Frank Watts, Ph.D., Instructor in Physiology, University of California, Berkeley, Cal. (50). F K
*Bancroft, Wilder Dwight, Professor of Chemistry, Cornell University, Ithaca, N. Y. (50). 1901. C
BANGS, LEMUEL BOLTON, M.D., 127 E. 34th St., New York, N. Y. (36).

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*Bangs, Outram, 240 Beacon St., Boston, Mass. (47). 1900. **F**

Banks, William C., Electrician, Gordon Battery Co., 15 Laight St., New York, N. Y. (50). **D**

Barber, Amzi L., 11 Broadway, New York, N. Y. (49).

*Barbour, Prof. Erwin Hinckley, The Univ. of Nebraska, Lincoln, Nebr. (45). 1898. **E**

*Bardeen, Charles Russell, Anatomical Laboratory, Wolfe and Monument Sts., Baltimore, Md. (50). 1901. **F K**

BARGE, B. F., Mauch Chunk, Pa. (33).

*BARKER, PROF. G. F., 3909 Locust St., Philadelphia, Pa. (13). 1875. **B C**

Barker, Mrs. Martha M., 42 Eleventh St., Lowell, Mass. (31). **E H**

*Barnard, Edward E., Yerkes Observatory, Williams Bay, Wis. (26). 1883. **A**

Barnes, Albert, Clemson College, S. C. (49). **D**

*Barnes, Charles Reid, Ph.D., Univ. of Chicago, Chicago, Ill. (33). 1885. **G**

Barnes, Lemuel Call, D.D., 310 Oakland Ave., Pittsburg, Pa. (51) **F**

Barnes, Edward W., Box 446, New York, N. Y. (49).

Barnhart, Arthur M., 185 Monroe St., Chicago, Ill. (42).

Barnhart, John H., M.D., Tarrytown, N. Y. (49). **G**

*Barnum, Miss Charlotte C., Ph.D., U. S. Coast and Geodetic Survey, Washington, D. C. (36). 1896. **A**

Barr, Charles Elisha, Professor of Biology, Albion College, Albion, Mich. (50). **F**

Barrell, Joseph, Asst. Professor of Geology, Lehigh University, Bethlehem, Pa. (51). **E**

Barrie, Dr. George, 1629 Fourteenth St., N. W., Washington, D. C. (49). **H I**

Barringer, Daniel Moreau, Geologist and Mining Engineer, 460 Bullitt Building, Philadelphia, Pa. (50). **D E**

Barrows, Franklin W., M.D., 45 Park St., Buffalo, N. Y. (47). **F**

*Barrows, Walter B., Agricultural College, Mich. (40). 1897. **F**

*Bartlett, Prof. Edwin J., Dartmouth College, Hanover, N. H. (28). 1883. **C**

Bartlett, Francis, 40 State St., Boston, Mass. (50). **I**

*Bartlett, John R., Captain U. S. N., 1622 21st St., N. W., Washington, D. C. (30). 1882. **B E**

*Bartley, Elias H., M.D., 21 Lafayette Ave., Brooklyn, N.Y. (33). 1894. **C**

*Barton, G. E., 212 North 3d St., Millville, N. J. (46). 1898. **C**

*Barton, George Hunt, 16 Lexington Ave., Cambridge, Mass. (47). 1900.

Barton, Philip Price, E.E., 127 Buffalo Ave., NiagaraFalls, N. Y., Sup't Niagara Falls Power Co. (50). **D E**

*Barton, Samuel M., Ph.D., The Univ. of the South, Sewanee, Tenn. (43). 1899. **A**

Bartow, Edward, Ph.D., Kansas State University, Lawrence, Kan. (47) **C**

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*Barus, Carl, Ph.D., Wilson Hall, Brown Univ., Providence, R. I. (33). 1887. **B**

Barwell, John William, Waukegan, Ill. (47).

*Bascom, Miss Florence, Bryn Mawr College, Bryn Mawr, Pa. (42). 1897. **E**

Bashore, Dr. Harvey B., West Fairview, Pa. (46). **E**

*Baskerville, Charles, Univ. of North Carolina, Chapel Hill, N. C. (41). 1894. **C E**

Baskett, James Newton, Mexico, Mo. (50). **F I**

Bassett, Carroll Phillips, C.E., Ph.D., Consulting Engineer, Summit, N. J. (51). **D**

Bates, Rev. John Mallery, Callaway, Neb. (50). **G I**

Bauder, Arthur Russell, Instructor in Physics, Boardman High School, New Haven, Conn. (50). **B**

*Bauer, Louis A., Ph.D., U. S. C. and G. Survey, Washington, D. C. (40). 1892. **A**

*Bausch, Edw., P. O. Drawer 1033, Rochester, N. Y. (26). 1883. **A B C F**

Bausch, Henry, P. O. Drawer 1033, Rochester, N. Y. (41).

Baxter, James Phinney, President, Maine Historical Society, Portland, Maine. (50). **H I**

Beach, Miss Alice M., 932 W. Illinois St., Urbana, Ill. (50). **F**

Beach, Charles Coffing, M.D., 54 Woodland St., Hartford, Conn. (50). **K**

Beach, Harry Wilber, Manufacturer, Montrose, Pa. (50). **D**

Beach, Henry Harris Aubrey, M.D., 28 Commonwealth Ave., Boston, Mass. (50) **F K**

*Beach, Spencer Ambrose, N. Y. Exper. Station, Geneva, N. Y. (41). 1900. **G**

*Beal, Prof. Wm. James, Agricultural College, Mich. (17). 1880. **G**

Bean, Thos. E., Box 441, Galena, Ill. (28). **F**

*Beardsley, Arthur, Ph.D., Swarthmore College, Swarthmore, Pa. (33). 1885. **D**

*Beardsley, Arthur E., Professor of Biology, Colorado State Normal School, Greeley, Colo. (50). 1901. **F**

Becher, Franklin A., 234 Oneida St., Milwaukee, Wis. (41). **A I**

*Becker, Dr. Geo. F., U. S. Geol. Survey, Washington, D. C. (36). 1890. **E**

Beckwith, Miss Florence, 394 Alexander St., Rochester, N. Y. (45). **G**

*Bedell, Frederick, Ph.D., Cornell Univ., Ithaca, N. Y. (41). 1894. **A B**

Beede, Joshua William, Bloomington, Ind. (50). **E**

Beekman Gerard, 47 Cedar St., New York, N. Y. (49).

Beers, M. H., 410 Broadway, New York, N. Y. (50). **I**

Behrend, Bernhard Arthur, C.E., E.E., Station H, Cincinnati, Ohio. (50) **D E**

*Bell, Alex. Graham, 1331 Conn. Ave., N. W., Washington, D. C. (26). 1879. **B H I**

*Bell, Alex. Melville, 1525 35th St., Washington, D. C. (31). 1885. **H**

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BELL, C. M., M.D., 320 Fifth Ave., New York, N. Y. (36).
Bell, George, Mineralogist, 200 S. Washington Ave., Denver, Colo. (50). **E G**
*Bell, Robert, M.D., LL.D., F.R.S., Geol. Survey, Ottawa, Can. (38). 1889. **E F**
Belmont, August, 23 Nassau S.t, New York, N. Y. (50). **I**
*Beman, Wooster W., 813 E. Kingsley St., Ann Arbor, Mich. (34). 1886. **A**
Benedict, James H., 704 Lord's Court, New York, N. Y. (49).
*BENJAMIN, MARCUS, U. S. National Museum, Washington, D. C. (27). 1887. **C**
*Benjamin, Rev. Raphael, Hotel Premier, E. 72nd St., New York, N. Y. (34). 1887. **E F G H**
*Benneson, Miss Cora Agnes, A.M., LL.B., 4 Mason St., Cambridge, Mass. (47). 1899. **H I**
Bennett, Charles W., Coldwater, Mich. (50). **E**
Bennett, Henry C., 256 W. 42d St., New York, N. Y. (43).
Bennett, Prof. William Z., Univ. of Wooster, Wooster, Ohio (48). **C**
Benson, Frank Sherman, 214 Columbia Heights, Brooklyn, N. Y. (49).
Bentley, William B., Ohio University, Athens, Ohio. (51). **C**
Bentley, Wilson A., Nashville, Vt. (48).
Bentley, Wray Annin, Instructor in Metallurgy, School of Applied Science, Columbia University, New York, N. Y. (50). **E**
Benton, Josiah H., Jr., Ames Building, Boston, Mass. (50). **I**
Bergey, David H., S.E. cor. 34th and Locust Sts., Philadelphia, Pa. (48).
*Bergström, John Andrew, Ph.D., Associate Professor of Psychology and Pedagogy, Indiana University, Bloomington, Ind. (50). 1901. **I**
Berkeley, Wm. N., Ph.D., Box 65, San Juan, Porto Rico (49). **C**
Berkey, Charles Peter, Ph.D., Instructor in Mineralogy, University of Minnesota, Minneapolis, Minn. (50). **E**
Bermann, I., M.D., 1010 I St., N. W., Washington, D. C. (49). **H**
Bernays, Augustus Charles, M.D., 3623 Laclede Ave., St. Louis, Mo. (50). **F K**
Bernheimer, Charles L., 43 E. 63rd St., New York, N. Y. (49).
Berry, Edgar H., Draftsman in charge Equipment Department, Navy Yard, Brooklyn, N. Y. (50). **D**
Berry, Edward W., News Building, Passaic, N. J. (50). **I**
Berry, John Wilson, C.E., Pittston, Pa. (47). **A B D E I**
*Bessey, Charles Edwin, Ph.D., LL.D., Univ. of Nebraska, Lincoln, Nebr. (21). 1880. **G**
*Bessey, Ernst A., U.S. Dep't Agriculture, Washington, D. C. (49). 1901. **G**
Bethea, Solomon Hix, U. S. Attorney, Chicago Club, Chicago, Ill. (50). **I**
Bethel, Ellsworth, Director Department of Botany, Academy of Science, Denver, Colo. (50). **F G**
Bevier, Miss Isabel, Univ. of Illinois, Urbana, Ill. (46). **C**
*Beyer, Prof. Samuel W., Iowa Agricultural College, Ames, Ia. (47). 1900. **E**

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*Bickmore, Prof. Albert S., Amer. Mus. Nat. History, Central Park, New York, N. Y. (17). 1880. **H**

Biddle, James G., 1024 Stephen Girard Building, Philadelphia, Pa. (33).

Bien, Julius, 140 Sixth Ave., New York, N. Y. (34). **E H**

Bierly, Prof. H. E., State Seminary, Tallahassee, Fla. (49). **H**

Bigelow, Edward F., Editor of "Popular Science," Stamford, Conn. (49).

*Bigelow, Prof. Frank H., U. S. Weather Bureau, Washington, D. C. (36). 1888. **A**

Bigelow, Samuel Lawrence, Ph.D., Asst. Professor of General Chemistry, University of Michigan, Ann Arbor, Mich. (50). **C**

Biggar, Hamilton F., M.D., 176 Euclid Ave., Cleveland, Ohio. (40). **B F**

Biggs, Charles, 13 Astor Place, New York, N. Y. (50). **I**

Bigney, Andrew J., Professor of Biology and Geology, Moores Hill College, Moores Hill, Ind. (50). **E F**

Billings, Miss E., 279 Madison Ave., New York, N. Y. (50). **I**

Billings, Miss Laura, 279 Madison Ave., New York, N. Y. (50). **I**

BISHOP, HEBER R., Mills Building, New York, N. Y. (36).

Bishop, L. B., M.D., 77 Whitney Ave., New Haven, Conn. (50). **I**

Bissell, Leslie Dayton, Ph.D., Hotchkiss School, Lakeville, Conn. (50). **B**

*BIXBY, MAJOR W. H., Corps of Engineers, U. S. A., U. S. Engineer Office, Jones Bldg., Detroit, Mich. (34). 1892. **D**

Black, Newton Henry, 10 Westerly St., Roxbury, Mass. (50). **B**

Blackall, Clarence Howard, Architect, 1 Somerset St., Boston, Mass. (50). **D**

Blackburn, Joseph E., State Dairy and Food Commissioner, Columbus, Ohio. (50). **F I**

Blackmar, Frank Wilson, Professor of Sociology and Economics, University of Kansas, Lawrence, Kan. (50). **H I**

Blackmore, Henry S., 206 S. 9th Ave., Mount Vernon, N. Y. (49).

*Blair, Andrew A., 406 Locust St., Philadelphia, Pa. (44). 1896. **C**

*Blake, Clarence J., M.D., 226 Marlborough St., Boston, Mass. (24). 1877. **B F**

*Blake, Edwin Mortimer, 1910 Addison St., Berkeley, Cal. (43). 1901. **A**

*Blake, Francis, Auburndale, Mass. (23). 1874. **A B**

Blake, Fred. C., Boulder, Colo. (50). **C**

Blake, John Bapst, M.D., 302 Beacon St., Boston, Mass. (50). **F K**

Blake, Joseph A., M.D., 601 Madison Ave., New York, N. Y. (50). **K**

Blakeman, Mrs. Birdseye, 9 E. 44th St., New York, N. Y. (49).

Blakeslee, Olin Safford, Boulder, Colo. (50). **B D E**

Blasdale, Walter Charles, Ph.D., Instructor in Chemistry, University of California, Berkeley, Cal. (50). **C**

*Bleile, Albert M., M.D., State University, Columbus, Ohio. (37). 1896. **F**

BLISH, W. G., Niles, Mich. (33). **B D**

Bliss, Charles B., Ph.D., The Elmer Gates Laboratory of Psychology and Psychurgy, Chevy Chase, Md. (49). **H I**

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Bliss, Hon. Cornelius N., 117 Duane St., New York, N. Y. (49).
Bloodgood, John H., 6 W. 40th St., New York, N. Y. (49).
BLOUNT, HENRY FITCH, "The Oaks," Washington, D. C. (32). **B I**
Boas, Emil L., 37 Broadway, New York, N. Y. (50). **I**
*Boas, Dr. Franz, Am. Mus. Nat. History, Central Park, New York, N.Y. (36). 1888. **H I**
*Bodine, Prof. Donaldson, Wabash College, Crawfordsville, Ind. (45). 1899. **E F**
*Bogert, Marston Taylor, Havemeyer Hall, Columbia Univ., New York, N. Y. (47). 1900. **C**
Boggs, Lemuel S., care Sargent & Lundy, 1000 Isabella Bld'g, Chicago, Ill. (50). **D**
*Bohannan, Prof. Rosser D., Ohio State Univ., Columbus, Ohio (46). 1898. **A**
Boies, Henry Martyn, President Moosic Powder Co., 530 Clay Ave., Scranton, Pa. (50). **C**
Bolles, Newton Alden, 1457-59 Ogden St., Denver, Colo. (50). **C**
*Bolley, Henry L., Agricultural College, North Dakota (39). 1892. **G**
*BOLTON, DR. H. CARRINGTON, Cosmos Club, Washington, D. C. (17). 1875. **C**
*Bolton, Thaddeus L., Ph.D., Dept. Philosophy, University of Nebraska, Lincoln, Neb. (50). 1901. **H I**
*Bond, Geo. M., The Pratt & Whitney Co., Hartford, Conn. (33). 1885. **D**
Bond, R. I., M.D., Hartshorne, Ind. Ter. (50). **K**
*Bookman, Samuel, Ph.D., 9 E. 62nd St., New York, N. Y. (47). 1900. **C**
Boon, John Daniel, Professor of Physics, Chemistry and Geology, John Tarleton College, Stephenville, Texas (50). **B C E**
Booraem, J. V. V., 204 Lincoln Place, Brooklyn, N. Y. (36).
Booth, Edward, Instructor in Chemistry, Univ. of California, 1214 Harrison St., Oakland, Cal. (50). **C**
*Booth, Miss Mary A., 60 Dartmouth St., Springfield, Mass. 1894. (34). **F G I**
Bossi, Arnold L., Ph.D., 1962 Elm St., Chemist and Colorist, Manchester Mills, Manchester, N. H. (50). **C**
*Bouscaren, Louis Frederic Gustav, Chief Engineer, Water Works Commission, City Hall, Cincinnati, Ohio. (50). 1901. **D**
*Bouton, Charles Leonard, Instructor in Mathematics, Harvard University, Cambridge, Mass. (50). 1901. **A**
Boutwell, John Mason, U. S. Geol. Survey, Washington, D. C. (46). **E**
*Bowditch, Charles P., 28 State St., Boston, Mass. (43). 1897. **H**
Bowditch, Miss Charlotte, Pond St., Jamaica Plain, Mass. (50). **I**
*Bowditch, Prof. H. P., Jamaica Plain, Mass. (28). 1880. **B F H**
Bowker, R. R., 28 Elm St., New York, N. Y. (43). **B**
Bowlus, E. Lingan, Professor of Biology, Mt. Union College, Alliance, Ohio. (50). **F**

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Bowman, Joseph H., Resident Engineer, Vera Cruz and Pacific Ry., Apartado 21, Cordoba, Mexico. (50). **D**

Bownocker, Prof. J. A., Ohio State University, Columbus, O. (48). **E**

*Bowser, Prof. E. A., Rutgers College, New Brunswick, N. J. (28). 1881.

*Boyd, James E., Ohio State Univ., Columbus, Ohio. (46). 1899. **B**

*Boyé, Martin H., M.D., Coopersburg, Pa. (1). 1896. **C**

*Brace, Prof. D. B., Univ. of Nebraska, Lincoln, Neb. (48). 1900.

Brackenridge, George W., San Antonio, Texas. (41). **I**

Brackett, Byron B., Ph.D., Rutgers College, New Brunswick, N. J. (46). **B**

*Brackett, Prof. C. F., Princeton University, Princeton, N. J. (19). 1875. **B**

Brackett, Frank Parkhurst, Professor of Mathematics, Pomona College, Claremont, Cal. (50). **A**

*Brackett, Richard N., Clemson College, S. C. (37). 1891. **C E**

Bradford, Prof. Joseph N., Ohio State Univ., Columbus, Ohio. (48).

*Bradford, Royal B., Commander, U. S. N., Navy Dep't, Washington, D. C. (31). 1891. **B D**

Bradley, Arthur C., Newport, N. H. (43).

Bradley, Charles S., 44 Broad St., New York, N. Y. (40).

Bradley, Charles Whiting, 1064 Ellicott Square, Buffalo, N. Y. (51). **D**

Bradley, Milton, Springfield, Mass. (44). **B**

Bradley, M. J., 36 Hart St., Brooklyn, N. Y. (43).

Bradley, Walter Parke, Ph.D., Professor of Chemistry, Wesleyan University, Middletown, Conn. (50). **C**

Bramwell, Geo. W., 335 Broadway, New York, N. Y. (43). **D**

*Branner, Prof. John C., Stanford University, Cal. (34). 1886. **E F**

Brasefield, Stanley E., Box 169, Agricultural College, Mich. (50). **A**

*Brashear, John A., Allegheny, Pa. (33). 1885. **A B D**

Brassill, Miss Sarah Ellen, South Weymouth, Mass. (47) **F G**

Braunnagel, Jules L. A., M.D., P. O. Box 925, San Antonio, Texas. (50) **F**

*Bray, William L., Professor of Botany, Univ. of Texas, Austin, Texas. (49). 1901. **G**

Brayton, Sarah H., M.D., The Hereford, Evanston, Ill. (33).

Brett, George P., Darien, Conn. (49).

Brewer, Charles Edward, Professor of Chemistry, Wake Forest College, Wake Forest, N. C. (50). **C**

*Brewer, Prof. Wm. H., 418 Orange St., New Haven, Conn. (20). 1875. **E F I**

Brewster, George Richard, Newburgh, N. Y. (50). **I**

Brice, Judge Albert G., 901 Hennen Bldg., New Orleans, La. (32). **H**

Briggs, Edward Cornelius, Harvard Medical School, Boston, Mass. (50). **F K**

*Briggs, Lyman J., U.S. Dep't Agriculture, Washington, D. C. (48). 1901. **B**

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*Brigham, Albert Perry, Professor of Geology, Colgate Univ., Hamilton, N. Y. (41). 1900. **E**

Bristol, John I. D., 1 Madison Ave., New York, N. Y. (49).

*Bristol, Wm. H., Stevens Institute, Hoboken, N. J. (36). 1894. **A B D**

*Britton, N. L., Ph.D., N. Y. Botanical Garden, Bronx Park, New York, N. Y. (29). 1882. **E G**

Britton, Wiley, Bureau of Pensions, Springfield, Mo. (40). **F**

Bronson, Dr. E. B., 123 W. 34th St., New York, N. Y. (49).

Brooks, Albert A., Kansas City, Kan. (50). **F G**

Brooks, Rev. Earle Amos, 161 Laidley St., Charleston, W. Va. (50). **F**

Brooks, Morgan, Professor of Electrical Engineering, Univ. of Illinois, Urbana, Ill. (50). **D**

Brooks, Prof. Wm. P., Amherst, Mass. (38). **C F**

*Brooks, Wm. R., D.Sc., Director Smith Observatory, Geneva, N. Y. (35). 1886. **A B D G**

Brown, Amos Peaslee, Ph.D., Assistant Professor of Geology and Mineralogy, Univ. of Pennsylvania, Philadelphia, Pa. (50). **E**

Brown, Elisha R., President Stafford Savings and National Banks, 50 Silver St., Dover, N. H. (50). **I**

Brown, Harold W., Lehigh Univ., So. Bethlehem, Pa. (48). **B C**

BROWN, JOSEPH STANFORD, 241 S. 5th St., Reading, Pa. (50). **D**

Brown, Newton H., Delaware College, Newark, Delaware. (48). **B D**

*Brown, Robert, Yale University Observatory, New Haven, Conn. (11). 1874. **A**

*Brown, Mrs. Robert, New Haven, Conn. (17). 1874.

Brown, Robert Marshall, 68 Kirkland St., Cambridge, Mass. (48).

Brown, Samuel B., Morgantown, W. Va. (40). **E**

Brown, Stewardson, Germantown, Pa. (50). **I**

Brown, S. J., U. S. Naval Academy, Annapolis, Md. (49).

Brown, W. L., 42 West 72d St., New York, N. Y. (50). **I**

Brownell, Silas B., 71 Wall St., New York, N. Y. (36).

Browning, Philip Embury, Kent Chemical Laboratory, Yale University, New Haven, Conn. (46). **C**

Bruggerhof, F. W., 36 Cortlandt St., New York, N. Y. (49).

*Brühl, Gustav, cor. John and Hopkins Sts., Cincinnati, Ohio. (28). 1886. **H**

Brundage, Albert H., M.D., 1153 Gates Ave., Brooklyn, N. Y. (43). **F G H**

Bruner, Henry Lane, Ph.D., Professor of Biology, Butler College, Indianapolis, Ind. (50). **F**

*Bruner, Lawrence, Professor of Entomology, Univ. of Nebraska, Lincoln, Neb. (50). 1901. **F**

BRUNTON, DAVID WILLIAM, Mining Engineer, 865 Grant Ave., Denver, Colo. (50). **D E**

*Brush, Charles F., 1003 Euclid Ave., Cleveland, Ohio. (35). 1886. **B**

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*Brush, Prof. George J., Yale Univ., New Haven, Conn. (4). 1874. C E
*Bryan, Prof. William L., Indiana Univ., Bloomington, Ind. (49). 1900. H
Bryant, Miss D. L., 218 Ashe St., Greensboro, N. C. (42). E
Buchholz, Carl Waldemar, Chief Engineer, Erie R. R. Co., 21 Cortlandt St., New York, N. Y. (51). D E
*Buchner, Edward F., Clark University, Worcester, Mass. (49). 1901. H
*Buckhout, W. A., State College, Pa. (20). 1881. F
Buckingham, Charles L., 195 Broadway, New York, N. Y. (28).
Buffum, Prof. Burt C., Agric'l Coll., Fort Collins, Colo. (42). G
Buist, John Robinson, M.D., City Board of Health, Nashville, Tenn. (50). K
*Bull, Prof. Storm, University of Wisconsin, Madison, Wis. (44). 1897. D
Bullard, Warren Gardner, Ph.D., Instructor in Mathematics, Syracuse University, Syracuse, N. Y. (50) A
Bullene, Mrs. Emma F. Jay, 1431 Court Place, Denver, Colo. (50). H
*Bumpus, Prof. H. C., Brown Univ., Providence, R. I. (49). 1900.
Bunker, Henry A., M.D., 158 Sixth Ave., Brooklyn, N. Y. (50). I
*Burbank, Luther, Santa Rosa, Cal. (50). 1901. G
Burbidge, Frederick, Mgr. Bunker Hill and Sullivan Mining and Concentrating Co., Kellogg, Idaho. (50). D E
*Burgess, Edward S., 11 W. 88th St., New York, N. Y. (47). 1901. G
*Burgess, Dr. Thomas J. W., Medical Sup't Protestant Hospital for the Insane, Montreal, Can. (38). 1889. G
Burgwyn, Collinson Pierrepont Edwards, Consulting Engineer, 819 Main St., Richmond, Va. (51). D
Burke, M. D., C.E., 404 Pike Bldg., Cincinnati, Ohio. (50). A B C D E
Burke, Robert E., Instructor in Chemistry, Mechanic Arts High School, Boston, Mass. (50). C
Burnham, Edward J., Manchester, N. H. (47). F
Burr, I. Tucker, Jr., Readville, Mass. (50). I
*Burr, Prof. William H., Columbia University, New York, N.Y. (31). 1883.
*Burt, Edward Angus, Ph.D., Professor of Natural History, Middlebury College, Middlebury, Vt. (50). 1901. G
Burton, Prof. Alfred E., Mass. Inst. Technology, Boston, Mass. (40). E
Busch, Frederick Carl, M.D., 145 Allen St., Buffalo, N. Y. (49).
Bush-Brown, Henry Kirke, Sculptor, Newburgh, N. Y. (50). E I
*Butler, Amos W., Secretary Board of State Charities, Indianapolis, Ind. (30). 1885. F H
Butler, Frank Edward, President of Grayson College, Whitewright, Texas. (50). I
Butler, Matthew Joseph, Civil Engineer, 22 Wellington Place, Toronto, Ontario, Canada (51). D
Butterfield, Arthur Dexter, Assistant Professor of Mathematics, University of Vermont, Burlington, Vt. (50). A D
Butterworth, Irvin, Denver Gas and Electric Co., Denver, Colo. (50). B

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Butts, Edward, Pontany, C.E., Chief Engineer, Am. Writing Paper Co., Holyoke, Mass. (51. **D**

Cabot, Samuel, Manufacturing Chemist, 70 Kilby St., Boston, Mass. (50). **C**

Cady, Walter G., Ph.D., 127 Power St., Providence, R. I. (49). **B**

*Cain, William, Professor of Mathematics, University of North Carolina, Chapel Hill, N. C. (50). 1901. **A D**

*Cajori, Florian, Professor of Mathematics, Colorado College, Colorado Springs, Colo. (50). 1901. **A**

Calder, George, 105 East 22d St., New York, N. Y. (50).

*Caldwell, Prof. Francis C., Ohio State University, Columbus, Ohio. (46). 1898. **B D**

*Caldwell, Prof. George C., Cornell University, Ithaca, N. Y. (23). 1875. **C**

Caldwell, Prof. Otis W., State Normal School, Charleston, Ill. (49). **G**

*Calkins, Gary N., Columbia University, New York, N. Y. (49). 1901. **F**

Calkins, Marshall, M.D., 14 Maple St., Springfield, Mass. (29).

Calvert, Philip P., Ph.D., Instructor in Zoology, Biological Hall, University of Penna., Philadelphia, Pa. (50). **F**

Calvert, Prof. Sidney, Univ. of Missouri, Columbia, Mo. (47) **C.**

*Calvin, Prof. Samuel, Dir. Iowa Geol. Surv., Iowa City, Iowa. (37). 1889. **E F**

Came, Virgil M., 315 Quincy Building, Denver, Colo. (50). **E**

*Cameron, Frank K., Ph.D., Chemist, Bureau of Soils, U. S. Dep't Agriculture, Washington, D. C. (49). 1901. **C**

Cammann, Hermann H., 43 W. 38th St., New York, N. Y. (49).

*Campbell, Douglas H., Professor of Botany, Stanford University, Cal. (34). 1888. **G**

Campbell, Leslie Lyle, Ph.D., Westminster College, Fulton, Mo. (48).

*Campbell, William Wallace, Director of Lick Observatory, Mt. Hamilton, Cal. (50). 1901. **A**

*Canby, William M., 1101 Delaware Avenue, Wilmington, Del. (17). 1878. **G**

*Cannon, George Lyman, Instructor in Geology, Denver High School (No. 1), Denver, Colo. (39). 1901. **E**

Capp, John Allan, Mechanical Engineer, Schenectady, N. Y. (50). **D**

Card, Fred W., Kingston, R. I. (45). **G**

Carey, E. P., Professor of Chemistry, Physics and Geology, University of the Pacific, College Park, Cal. (50). **B C**

*Carhart, Prof. Henry S., Univ. of Michigan, Ann Arbor, Mich. (29). 1881. **B**

*Carleton, M. A., U. S. Dep't Agriculture, Washington, D. C. (42). 1894. **G**

Carnaghan, Edwin Dixon, Mechanical Engineer, Durango, Do, Mexico. (50). **D**

Carnahan, Charles T., Mining Engineer, Equitable Building, Denver, Colo. (50). **D E**

Carnegie, Thomas Morrison, Trustee of Carnegie Institute, Dungeness, Fernandina, Fla. (50). **F**

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Carnell, Frederic J., Assistant in Physics, Sheffield Scientific School, New Haven, Conn. (50). **B**

Carpenter, Ford A., U. S. Weather Bureau, San Diego, Cal. (44). **B**

Carpenter, Franklin R., Ph.D., Mining Expert, 1420 Josephine St., Denver, Colo. (50). **D E**

Carpenter, Geo. O., Jr., National Lead Co., St. Louis, Mo. (29).

*Carpenter, Louis G., Agric. College, Fort Collins, Colo. (32). 1889. **A B**

Carroll, James, M.D., 1444 S St., N. W., Washington, D. C. (50). **F K**

Carroll, James J., Waco, Texas. (50). **F**

Carss, Miss Elizabeth, Teachers' College, New York, N. Y. (49). **G**

Carter, Henry C., 475 West 143d St., New York, N. Y. (50).

Carter, James, M. D., Carbon, Wyoming. (50). **E K**

CARTER, JAMES C., 277 Lexington Ave., New York, N. Y. (36).

*Carter, James Madison G., M.D., Waukegan, Ill. (39). 1895. **F**

Carter, John E., Knox and Coulter Sts., Germantown, Pa. (33). **B H**

Carter, Marion H., Fiske Hall, Barnard College, New York, N.Y. (49).

Carter, William Harrison, Stone Mountain, Ga. (50). **A**

*Carus, Paul, Ph.D., La Salle, Ill. (40). 1895. **H**

Cary, Albert A., 95 Liberty St., New York, N. Y. (36). **D**

Cary, Mrs. Elizabeth M. L., 184 Delaware Ave., Buffalo, N. Y. (45). **E**

Case, Eckstein, Case School of Applied Science, Cleveland, Ohio. (47).

Case, Ermine Cowles, Prof. of Chemistry and Geology, State Normal School, Milwaukee, Wis. (50). **B C E**

*Casey, Thomas L., Major of Engineers, U. S. A., P. O. Drawer 71, St. Louis, Mo. (38). 1892. **D F**

Caswell, W. H., M.D., 201 West 55th St., New York, N. Y. (50).

Cathcart, Miss J. R., The Barnard, 71st St. and Central Park, New York, N. Y. (50).

*Catlin, Charles A., 133 Hope St., Providence, R. I. (33). 1895. **C**

*Cattell, H. W., M.D., 3709 Spruce St., Philadelphia, Pa. (50). 1901 **K**

*CATTELL, PROF. JAMES MCKEEN, Columbia Univ., New York, N.Y. (44). 1896. **B F H I**

Chamberlain, Charles Joseph, Dep't of Botany, University of Chicago, Chicago, Ill. (50). **G**

Chamberlain, Frederic M., U. S. Fish Commission, Washington, D. C. (51). **F**

*Chamberlin, T. C., Hyde Park Hotel, Hyde Park, Chicago, Ill. (21). 1877. **B E F H**

Chamberlin, W. E., Ph.D., 111 Water St., New York, N. Y. (50).

Chambers, Frank R., 569 Broadway, New York, N. Y. (50).

*Chandler, Prof. C. F., School of Mines, Columbia University, New York, N. Y. (19). 1875. **C**

*Chandler, Prof. Charles Henry, Ripon, Wis. (28). 1883. **A**

Chandler, Elwyn Francis, Instructor in Mathematics, University of North Dakota, University, N. Dak. (50). **A B**

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Chandler, Richard E., Stillwater, Oklahoma. (46). **B D**

*Chandler, Seth C., 16 Craigie St., Cambridge, Mass. (29). 1882. **A**

Chaney, Prof. Lucian W., Carleton College, Northfield, Minn. (45).

Channing, Walter, M.D., Brookline, Mass. (50). **I K**

*Chanute, O., 413 E. Huron St., Chicago, Ill. (17). 1877. **D I**

*Chase, Frederick L, Yale University Observatory, New Haven, Conn. (43). 1896. **A**

Chase, R Stuart, 53 Summer St., Haverhill, Mass. (18). **F**

*Chauvenet, Wm. M., Mining Engineer, 620 Chestnut St., St. Louis, Mo. (50). 1901. **C D**

*Cheesman, T. M., M.D., Garrison-on-Hudson, N. Y. (50) 1901. **K**

Cheney, Mrs. Ednah Dow, Jamaica Plain, Mass. (47).

*Cheney, Lellen Sterling, 318 Bruen St., Madison, Wis. (42). 1894. **G**

Cheney, Willard Colfax, Electrical Engineer, Portland, Oregon. (50). **D**

*Chester, Prof. Albert H., Rutgers College, New Brunswick, N. J. (29). 1882. **C F**

*Chester, Colby M., Captain U. S. N., The Everett, Washington, D. C. (28). 1897. **E**

Chester, Wayland Morgan, Associate Professor of Biology, Colgate University, Hamilton, N. Y. (50). **F**

*Chickering, J. W., The Portner, Washington, D. C. (22). 1877. **G I**

Chilcott, Ellery Channing, Professor of Geology, Agricultural College, Brookings, S. D. (50). **E**

*Child, Charles Manning, Instructor in Zoology, University of Chicago, Chicago, Ill. (50). 1901. **F**

*Child, Clement D., Colgate Univ., Hamilton, N. Y. (44). 1899. **B**

Childs, Arthur Edward, V.P. and Treas. The Light, Heat and Power Corporation, 23 Central St., Boston, Mass. (50). **B D I**

Childs, James Edmund, Civil Eng., 300 W. 93d St., New York, N.Y. (51). **D**

Chisholm, Hugh J., 813 Fifth Avenue, New York, N. Y. (50).

Chisolm, George E., 19 Liberty St., New York, N. Y. (50).

*Chittenden, Frank Hurlbut, U. S. Dep't Agriculture, Washington, D.C. (48). 1901. **F**

*Chittenden, Russell H., Director of Sheffield Scientific School, Yale University, New Haven, Conn. (50). 1901. **C F**

Chittenden, Thomas A., Instructor in Mechanical Engineering, A. and M. College, W. Raleigh, N. C. (50). **D**

*Christie, James, Chief. Mech. Engineer Am. Bridge Co., Pencoyd, Pa. (33). 1894. **D**

Chrystie, Wm. F., Hastings-on-Hudson, New York, N. Y. (36).

Church, E. D., Jr., 63 Wall St., New York, N. Y. (50).

Church, Royal Tyler, Turin, N. Y. (38). **D F**

*Chute, Horatio N., Ann Arbor, Mich. (34). 1889. **A B C**

*CILLEY, FRANK H., Mass. Inst. Technology, Boston, Mass. (49). 1901. **A B D**

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Clancy, Michael Albert, 1426 Corcoran St., Washington, D. C. (40). **H**
Clapp, D.C., Steel Manufacturer, 718 Amberson Ave., Pittsburg, Pa. (50). **D**
Clark, Alexander S., Westfield, N. J. (33).
Clark, Mrs. Alfred Corning, 347 W. 89th St., New York, N. Y. (49).
Clarke, Miss Cora H., 91 Mt. Vernon St., Boston, Mass. (47). **F G**
Clark, Edmund, 426 Sanford Ave., Flushing, L. I., N. Y. (50).
Clark, Edward, 417 Fourth St., N. W., Washington, D. C. (40).
Clark, Ernest P., 229 W. 18th St., New York, N. Y. (50). 1901. **D**
*Clarke, Prof. F. W., U. S. Geol. Survey, Washington, D. C. (18). 1874. **C**
*Clark, Gaylord Parsons, Professor of Physiology, Syracuse University, Syracuse, N. Y. (50). 1901. **F K**
Clark, Herbert A., Haskell Institute, Lawrence, Kansas. (50.) **B C**
Clark, Hubert Lyman, Ph.D., Professor of Biology, Olivet College, Olivet, Mich. (50). **F**
Clark, James Frederick, M.D., Fairfield, Iowa. (50). **I K**
*Clark, Prof. John E., 445 Orange St., New Haven, Conn. (17). 1875. **A**
Clark, John Jesse, Dean of Faculty, International Correspondence Schools, Scranton, Pa. (50). **B D**
*Clarke, John Mason, Ph.D., Ass't State Geologist and Palæontologist State Hall, Albany, N. Y. (45). 1897. **E**
*Clark, John S., 110 Boylston St., Boston, Mass. (31). 1901. **B C I**
Clark, Joseph E., M.D., 396 Fourth St., Brooklyn, N. Y. (43). **A E**
Clark, Oliver Durfee, 590 Halsey St., Brooklyn, N. Y. (41). **E F**
*Clarke, Prof. Samuel Fessenden, Williams College, Williamstown, Mass. (50). 1901. **F**
Clarke, Dr. Thomas, care Tenn. Coal and Iron Co., Birmingham, Ala. (48). **C**
Clark, Thomas H., Box 166 Plymouth, N. H. (40).
Clark, Wm. Brewster, M.D., 50 E. 31st St., New York, N. Y. (33). **C F**
*Clark, Wm. Bullock, Ph.D., Johns Hopkins University Baltimore, Md. (37). 1891. **E**
*Claypole, Dr. Agnes M., Pasadena, Cal. (46). 1899. **F**
*Claypole, Miss Edith J., Pasadena, Cal. (46). 1899. **F**
Cleaver, Albert N., South Bethlehem, Pa. (50). **D**
Clerc, Frank L., Professor of Metallurgy and Assaying, Colorado State School of Mines, Hotel Metropole, Denver, Colo. (50). **C D**
Clifton, Richard S., Assistant Secretary A. A. A. S., West Washington, D. C. (49). **F**
Cline, Isaac M., M.D., U. S. Weather Bureau, New Orleans, La. (50). **K**
*Cloud, John W., 974 Rookery, Chicago, Ill. (28). 1886. **A B D**
Clough, Albert L., Box 114, Manchester, N. H. (45). **B**
Coates, Charles E., Ph.D., Louisiana State Univ., Baton Rouge, La. (46). **C**
Cobb, Arthur, Architect, 600 Equitable Building, Louisville, Ky. (50). **D**
Cobb, Prof. Collier, University of North Carolina, Chapel Hill, N. C. (49).
*Cochran, C. B., 514 South High St., West Chester, Pa. (43). 1896. **C**

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*Cockerell, T. D. A., Consulting Entomologist, N. M. Agric. Exper. Station, East Las Vegas, New Mexico. (50). 1901. F

Cockran, Hon. W. Bourke, 31 Nassau St., New York, N. Y. (50).

Coe, Henry W., M.D., "The Marquam," Portland, Oregon. (32). F H

Coffin, C. A., 44 Broad St., New York, N. Y. (50).

*Coffin, Selden J., Ph.D., Lafayette College, Easton, Pa. (22). 1874. A I

*Cogswell, Wm. B., Syracuse, N. Y. (33). 1891. D

Cohen, Mendes, Civil Engineer, 825 N. Charles St., Baltimore, Md. (50). D

Cohen, Solomon Solis, M.D., 1525 Walnut St., Philadelphia, Pa. (50). F K

Coit, Joseph Howland, Saint Paul's School, Concord, N. H. (50).

Coit, J. Milner, Ph.D., Saint Paul's School, Concord, N. H. (33). B C E

*Colburn, Richard T., Elizabeth, N. J. (31). 1894. F H I

Colby, Edward A., 128 Lincoln Ave., Newark, N. J. (49).

*Cole, Prof. Alfred D., Ohio State Univ., Columbus, Ohio. (39). 1891. B C

Colgate, Abner W., Morristown, N. J. (44).

Colie, Edw. M., East Orange, N. J. (30). E I

Collett, Samuel Williamson, Principal of High School, Urbana, Ohio. (50). G

Collier, Price, Tuxedo Park, N. Y. (50).

*Collin, Prof. Alonzo, Cornell College, Mount Vernon, Iowa. (21). 1891. B C

Collin, Rev. Henry P., 58 Division St., Coldwater, Mich. (37). H

*Collingwood, Francis, Elizabeth, N. J. (36). 1888. D

*Colvin, Verplanck, Supt. N. Y. State Adirondack Survey, Albany, N. Y. (28). 1880. E

*Comstock, Prof. Charles Worthington, State School of Mines, Golden, Colo. (47). 1901. A D

*Comstock, Prof. Geo. C., Washburn Observatory, University of Wisconsin, Madison, Wis. (34). 1887. A

*Comstock, Prof. Theo. B., Mining and Metallurgical Engineer, 534 Stinson Bldg., Los Angeles, Cal. (24). 1877. B D E

Comstock, Dr. T. Griswold, 3401 Washington Ave., St. Louis, Mo. (29). F H

Conant, Miss E. Ida, 42 W. 48th St., New York, N. Y. (33). F H I

*Conant, Prof. L. L., Polytechnic Institute, Worcester, Mass. (39). 1892. A

*Conklin, Edwin Grant, Professor of Biology, University of Pennsylvania, Philadelphia, Pa. (50). 1901. F

Connelley, C. B., Supervisor Industrial Schools, Allegheny, Pa. (49). I

Converse, Vernon G., 15th St. and Liberty Ave., Pittsburg, Pa. (50). D.

Cook, Dr. Charles D., 162 Remsen St., Brooklyn, N. Y. (25).

Cooke, George Willis, Park St., Wakefield Park, Wakefield, Mass. (47). H I

Cook, James B., Randolph Building, Memphis, Tenn. (50).

Cook, Melville T., Greencastle, Ind. (45). G

*Cook, Orator F., U. S. Dept. of Agriculture, Washington, D. C. (40). 1892. G

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Cook, Samuel R., Professor of Physics and Chemistry, Washburn College, Topeka, Kansas. (50). **B C**

*Cooley, Grace E., Ph.D., Wellesley College, Wellesley, Mass. (47). 1900. **G I**

*Cooley, Prof. LeRoy C., Vassar College, Poughkeepsie, N.Y. (19). 1880. **B C**

*Cooley, Prof. Mortimer E., University of Michigan, Ann Arbor, Mich. (33). 1885. **D**

Cooley, Robert A., Zoologist and Entomologist, Montana Agr'l College and Experiment Station, Bozeman, Montana. (50). **F**

Cooper, Hon. Edward, 12 Washington Square, N., New York, N. Y. (49).

Cooper, James Campbell, Room 5, Veale Block, Topeka, Kansas. (50). **C E**

*Copeland, Edwin Bingham, 653 E. 57th St., Chicago, Ill. (45). 1901. **G**

Corbett, L. C., U. S. Dep't Agriculture, Washington, D. C. (48). **G**

Cornman, Oliver P., Ph.D., 2252 N. 20th St., Philadelphia, Pa. (46). **H**

*Corthell, Elmer L., care Ministerio de Obras Publicas, Buenos Aires, Argentine Republic. (34). 1886. **D E I**

*Coulter, Prof. John M., University of Chicago, Chicago, Ill. (32). 1884. **G**

*Coville, Frederick V., U. S. Dep't Agriculture, Washington, D. C. (35). 1890. **G**

Cowell, John F., Botanic Garden, West Seneca, N. Y. (35). **G**

*Cowles, Alfred H., 656 Prospect St., Cleveland, Ohio. (37). 1897. **B C**

Cowles, Miss Louise F., Mt. Holyoke College, South Hadley, Mass. (47). **E**

Cox, Abraham Beekman, Civil Engineer, Cherry Valley, N. Y. (50). **D**

*Cox, Charles F., Grand Central Depot, New York, N. Y. (43). 1900. **F G**

Cox, Edmund Otis, C.E., Manhattan Railway Co., 11 Manhattan Ave., New York, N. Y. (51) **D**

Cox, Ulysses O., Professor of Biology, State Normal School, Mankota, Minn. (50). **F**

Coyle, Rev. John S., S. J., St. Agnes Hospital, S. Broad St., Philadelphia, Pa. (48). **B**

Crafts, Clayton Edward, 5433 Washington Boulevard, Chicago, Ill. (50). **I**

*Crafts, James Mason, Mass. Inst. Technology, Boston, Mass. (47). 1898. **C**

Crafts, Robert H., 2329 S. 6th St., Minneapolis, Minn. (32). **B I**

*Cragin, Francis Whittemore, Ph.D., 1715 Wood Ave., Colorado Springs, Colo. (29). 1890. **E F H**

Craig, John, College of Agriculture, Cornell University, Ithaca, N. Y. (41). **G**

Craig, Wallace, Zoological Laboratory, Univ. of Chicago, Chicago, Ill. (50). **F**

*Crampton, Chas. A., M.D., Office of Internal Revenue Commissioner, U. S. Treasury Dep't, Washington, D. C. (36). 1887. **C**

*Crandall, Charles S., Div. Forestry, Dep't Agriculture, Washington, D. C. (40). 1894.

Crandall, Francis A., 2219 15th St., N. W., Washington, D. C. (50). **I**

Crane, James M., Board of Education, Newburgh, N. Y. (50). **I**

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Crane, Walter, Sup't Carnegie Free Library, Braddock, Pa. (47). **G**
Cranford, J. P., Wakefield, New York, N. Y. (50).
Cranston, Robert E., E.M., M'g'r Ashburton Mining Co., Folsom, Cal. (50). **D E**
Crawford, David Francis, Sup't Motive Power, Penna. Co., Ft. Wayne, Ind. (50). **D**
Crawford, John, Leon, Nicaragua, Central America. (40). **E H**
*Crawford, Morris B., Middletown, Conn. (30). 1889. **B**
*Crawley, Edwin S., Ph.D., Springfield Ave., Chestnut Hill, Philadelphia, Pa. (45). 1900. **A**
Crehore, Albert Cushing, Brookside Park, Tarrytown, N. Y. (50). **D E**
Crockard, Frank Hearne, E.M., C.E., Assist. Mgr. Riverside Dep't National Tube Co., Lock Box 34, Wheeling, W. Va. (50). **D**
*Crocker, Francis B., Professor of Electrical Engineering, Columbia University, New York, N. Y. (50). 1901. **B D**
*Crockett, Prof. Charles W., Rensselaer Polytechnic Institute, Troy, N. Y. 39. (1894). **A D**
Crook, Alja Robinson, Ph.D., 1914 Sheridan Road, Evanston, Ill. (47). **E**
*Crosby, Prof. W. O., Mass. Institute Technology, Boston, Mass. (47). 1900. **E**
*Cross, Prof. Charles R., Mass. Inst. Technology, Boston, Mass. (29). 1880. **B**
Crouse, Hugh Woodward, M.D., Victoria, Texas. (50). **F K**
CROWELL, A. F., Woods Holl, Mass. (30). **C**
*Crowell, John Franklin, Bur. of Statistics, Treasury Dept., Washington, D. C. (50). 1901. **I**
Crozier, William, Brigadier-General and Chief of Ordnance, U. S. A., War Department, Washington, D. C. (50). **D**
Cruikshank, James, LL.D., 206 S. Oxford St., Brooklyn, N. Y. (36.)
Crump, Col. M. H., Ogden College, Bowling Green, Ky. (29). **E**
Cryer, Matthew H., M.D., D.D.S., 1420 Chestnut St., Philadelphia, Pa. (50). **F K**
*Culin, Stewart, Univ. of Pennsylvania, Philadelphia, Pa. (33). 1890. **H**
*Cumings, Edgar R., Bloomington, Ind. (48). 1901. **E**
*Cummings, Miss Clara E., Wellesley College, Wellesley, Mass. (47). 1899. **G**
Cummins, George Wyckoff, M.D., Belvidere, N. J. (50). **G K**
Cunningham, Francis A., 1613 Wallace St., Philadelphia, Pa. (3)3. **B D E**
Cunningham, John F., 446 Euclid Ave., Cleveland, Ohio (48). **G**
*Cunningham, Prof. Susan J., Swarthmore College, Swarthmore, Pa. (38). 1901. **A**
Cuntz, Johannes H., 325 Hudson St., Hoboken, N. J. (36).
Currie, C. A., M.D., P. O. Box 1606, Philadelphia, Pa. (48). **F**
Currier, Mrs. Moody, Myrtle and Ash Sts., Manchester, N. H. (50.)

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Curtis, Charles B., 9 East 54th St., New York, N. Y. (50).
Curtis, Geo. W., Weatherford, Texas. (50).
Curtis, William E., Post Building, Washington, D. C. (40). **H I**
*Cushing, Henry Platt, Adelbert College, Cleveland, Ohio (33). 1888. **E**
Cushing, John J., 1001 Union Trust Bldg., Cincinnati, Ohio. (50). **D**
*Cushman, Allerton, Ph.D., Instructor in Chemistry, Bryn Mawr College, Bryn Mawr, Pa. (50). 1901. **C**
*Cushny, Arthur R., Professor of Materia Medica and Therapeutics, Univ. of Michigan, Ann Arbor, Mich. (50). 1901. **K**
Cutler, Colman Ward, M.D., 36 East 33rd St., New York, N. Y. (50). **K**
Cutter, Irving S., Box 732, Lincoln, Neb. (50). **F G**
Cutter, W. D., College of Physicians and Surgeons, Columbia Univ., New York, N. Y. (50.) **K**
*Dabney, Charles W., Ph.D., President University of Tennessee, Knoxville, Tenn. (47). 1901. **C**
Daggette, Alvin S., M. D., 400 South Craig St., Pittsburg, Pa. (50). **F K**
*Dall, William H., Smithsonian Institution, Washington, D. C. (18). 1874. **F H**
Dalrymple, W. H., Prof. Vet. Science, La. State Univ. and A. & M. College, Baton Rouge, La. (50). **F K**
*Dana, Dr. Charles L., 50 W. 46th St., New York, N. Y. (46). 1889. **H**
*Dana, Edward Salisbury, New Haven, Conn. (23). 1875. **B E**
Danforth, Isaac Newton, M.D., 70 State St., Chicago, Ill. (50.) **K**
Daniel, John, Professor of Physics, Vanderbilt Univ., Nashville, Tenn. (50). **B**
Danielson, A. H., Agricultural College, Fort Collins, Colo. (50). **G**
*Darton, Nelson H., U. S. Geol. Survey, Washington, D. C. (37). 1893.
*Davenport, Charles Benedict, Ph.D., Univ. of Chicago, Chicago, Ill. (46). 1898. **F**
*Davenport, Eugene, Dean of the College of Agriculture, University of Illinois, Champaign, Ill. (39).
Davenport, Francis Henry, M.D., 419 Boylston St., Boston, Mass. (50). **K**
*Davidson, George, 2221 Washington St., San Francisco, Cal. (29). 1881. **A B D**
Davies, William G., 22 E. 45th St., New York, N. Y. (49).
Davis, Abial B., 129 East Lincoln Ave., Mt. Vernon, N. Y. (44). **A**
Davis, Andrew McFarland, 10 Appleton St., Cambridge, Mass. (35). **H**
Davis, Bergen, Columbia University, New York, N. Y. (49). **B**
*Davis, Bradley Moore, Dep't of Botany, Univ. of Chicago, Chicago, Ill. (45). 1897. **G**
Davis, Charles F., Fort Collins, Colo. (50). **C**
*Davis, C. H., Commander U. S. N., Navy Dep't, Washington, D. C. (40). 1896.
Davis, Edward E., 47 W. Main St., Norwich, N. Y. (50).
Davis, George S., P. O. Box 714, Detroit, Mich. (50).

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*Davis, Herman S., Ph.D., Director of International Latitude Station, Gaithersburg, Md. (50). 1901 **A**

*Davis, J. J., M.D., 1119 College Ave., Racine, Wis. (31). 1899. **F G**

Davis, John J., Attorney-at-law, Clarksburg, W. Va. (50). **I**

Davis, J. Woodbridge, 523 West 173d St., New York, N. Y. (47). **A**

Davis, Kary Cadmus, Ph.D., Professor of Horticulture and Forestry, State University, Morgantown, W. Va. (50). **G**

Davis, N. S., Jr., 291 Huron St., Chicago, Ill. (50). **F G**

Davis, Wm. Harper, Asst. in Psychology, Columbia Univ., New York, N. Y. (50). **H I**

*Davis, Prof. Wm. Morris, Cambridge, Mass. (33). 1885. **B E**

Davis, Wm. Walley, Virginia Iron, Coal and Coke Co., Bristol, Tenn. (50). **C**

Davison, Alvin, Ph.D., Lafayette College, Easton, Pa. (49).

Davison, John M., 340 Oxford St., Rochester, N. Y. (38). **C**

Dawson, Percy Millard, M.D., Instructor in Physiology, Johns Hopkins Medical School, Baltimore, Md. (50). **K**

*Day, Fisk H., M.D., 309 Sycamore St., Lansing, Mich. (20). 1874. **E F H**

*Day, William Scofield, Ph.D., Tutor in Physics, Columbia University, New York, N. Y. (50). 1901. **B**

Dean, Seth, C.E., Glenwood, Iowa. (34). **D**

Dean, Wm. H., 167 West River St., Wilkes-Barre, Pa. (50). **C**

Deans, John Sterling, Chief Engineer, Phoenix Bridge Co., Phoenixville, Pa. (51). **D**

de Benneville, James S., University Club, 1510 Walnut St., Philadelphia, Pa. (46). **C**

de Coppet, Henry, 22 West 17th St., New York, N. Y. (49).

Deens, Miss Anna M., 216 North Ave. W., Allegheny, Pa. (50). **F G**

de Forest, Robert W., 30 Broad St., New York, N. Y. (49).

de Funiak, Frederick, Consulting Engineer, 204 E. Chestnut St., Louisville, Ky. (51). **D**

*Deghuée, Joseph A., Ph.D., 247 Harrison St., Brooklyn, N. Y. (40). 1900. **C**

*Delabarre, E.B., Ph.D., Professor of Psychology, Brown University, Providence, R. I. (49). 1901. **H I**

Delafield, Maturin L., Jr., Fieldston, Riverdale, New York, N. Y. (43). **G**

Delafond, E., Ingenieur Chimiste, P. O. Box 252, San Juan, Porto Rico. (50). **C**

De Landero, Carlos F., Asst. Director Pachuca and Real del Monte Mining Co., Pachuca, Mexico. (36). **B C**

Delano, Frederic A., Supt. of Motive Power, C. B. and Q. Railroad, 209 Adams St., Chicago, Ill. (50). **D**

Delany, Patrick Bernard, E. E., Inventor, South Orange, N. J. (50). **D**

Dempster, Alexander, Stanton and Euclid Aves., Pittsburg, Pa. (50). **D**

*Dennis, David Worth, Professor of Biology, Earlham College, Richmond, Indiana. (50). 1901. **F**

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*Dennis, Louis Monroe, Cornell University, Ithaca, N. Y. (43). 1895. **C**

*Denton, Prof. James E., Stevens Institute, Hoboken, N. J. (36). 1888. **A B D**

Derby, George McClellan, Major, Corps of Engineers, U. S. A., 3232 Prytania St., New Orleans, La. (50). **D**

*Derby, Orville, A., Sao Paulo, Brazil, South America. (39). 1890.

DE RIVERA, JOSÉ. (29). Address wanted.

*de Schweinitz, E. A., M.D., U. S. Dept. Agriculture, Washington, D. C. (36). 1889. **C**

Detmers, Fredericka, 1315 Neil Ave., Columbus, Ohio. (48). **G**

Devereux, W. B., 99 John St., New York, N. Y. (50).

*Dewey, Lyster H., U. S. Dep't Agric., Washington, D. C. (40). 1899. **F G**

*Dexter, Franklin, M.D., Associate Professor of Anatomy, Harvard Medical School, Boston, Mass. (50). 1901. **K**

Dickerson, E. N., 141 Broadway, New York, N. Y. (49).

Diemer, Hugo, Univ. of Kansas, Lawrence, Kans. (49).

*Dimmock, George, Box 1597, Springfield, Mass. (22). 1874. **F**

Dimock, Mrs. Henry F., 25 East 60th St., New York, N. Y. (50).

Dimon, Miss Abigail Camp, 367 Genesee St., Utica, N. Y. (50). **F K**

Dinkey, Alva C., General Supt. Homestead Steel Works, Munhall, Pa. (50). **D**

Dinsmore, Prof. Thos. H., Jr., 1012 E. Adams St., Syracuse, N. Y. (29). **B C**

*Dixon, Roland B., Peabody Museum, Cambridge, Mass. (46). 1901. **H**

Dixon, Samuel Gibson, M.D., Acad. Nat. Sciences, 1900 Race St., Philadelphia, Pa. (50). **F F**

*Dodge, Charles Richards, U. S. Dept. of Agriculture, Washington, D. C. (22). 1874.

*Dodge, Charles Wright, Univ. of Rochester, Rochester, N. Y. (39). 1898. **F**

Dodge, D. Stuart, 225 Madison Ave., New York, N. Y. (49).

Dodge, Philip T., Tribune Building, New York, N. Y. (44). **B D**

*Dodge, Richard E., Teachers' College, Columbia Univ., New York, N.Y. (49). 1901. **E I**

Dodman, Alfred C., Jr., 235 W. 108th St., New York, N. Y. (50).

Doherty, Henry L., 40 Wall St., New York, N. Y. (48). **B C D**

*Dolbear, Prof. A. Emerson, Tufts College, Mass. (20). 1880. **B**

Dole, Rev. Charles Fletcher, Jamaica Plain, Mass. (50). **I**

Domenech, Manuel V., Civil Engineer and Architect, Lock Box 220, Ponce, Porto Rico. (50). **D I**

Donovan, Cornelius, Port Eads, La. (51).

*Doolittle, Prof. C. L., Univ. of Pennsylvania, Philadelphia, Pa. (25). 1885. **A**

*Dorsey, George A., Ph.D., Field Columbian Museum, Chicago, Ill. (39). 1892. **H**

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*Dorsey, N. Ernest, Ph.D., Annapolis Junction, Md. (46). 1898. **B**

Doty, Paul, Grand Rapids Gas Light Co., Grand Rapids, Mich. (43). **D**

Doubt, Prof. Thomas E., Univ. of Washington, Seattle, Wash. (48). **B**

Doughty, Mrs. Alla, Milford, Pa. (49).

Doughty, John W., 165 Johnston St., Newburgh, N. Y. (19). **E**

Douglas, Mrs. George William, Tuxedo Park, N. Y. (49).

Douglas, James, 99 John St., New York, N. Y. (49).

Douglas, Orlando B., 20 Pleasant St., Concord, N. H. (49).

*Douglass, Andrew E., Amer. Mus. of Nat. History, Central Park, New York, N. Y. (31). 1885. **H**

Dow, Alex., M.E., E.E., Mgr. Edison Illuminating Co., 844 Cass Ave., Detroit, Mich. (50). **D**

Dow, Herbert H., Midland, Mich. (47). **C**

Dowell, Philip, Ph.D., Professor of Natural Science, Muhlenberg College, Allentown, Pa. (50). **F**

Downing, Elliott Rowland, Ph.D., Professor of Biology, Northern State Normal School, Marquette, Mich. (51). **F**

Downs, Edgar Selah, Assistant in Physics, Yale University, New Haven, Conn. (50). **B**

*DRAPER, DANIEL, Ph.D., N.Y. Meteorological Observatory, Central Park, 64th St., Fifth Ave., New York, N. Y. (29). 1881. **A B D F**

Draper, Mrs. Henry, 271 Madison Ave., New York, N. Y. (49).

Drescher, Willibald A. E., P. O. Drawer 1033, Rochester, N. Y. (41). **F**

*Droppers, Garrett, President of the State University, Vermillion, S. Dak. (50). 1901. **I**

*Drown, Prof. Thos. M., Lehigh University, South Bethlehem, Pa. (29). 1881. **C**

Drummond, Isaac Wyman, Ph.D., 436 W. 22nd St., New York, N. Y. (36).

Dryer, Charles Redway, Professor of Geography, Indiana State Normal School, Terre Haute, Ind. (50). **E**

Duane, Russell, 911 Pine St., Philadelphia, Pa. (50). **I**

*Duane, William, Ph.D., Professor of Physics, State University, Boulder, Colo. (50). 1901. **B**

*DU BOIS, PROF. AUG. J., New Haven, Conn. (30). 1882. **A B D**

Du Bois, Howard Weidner, 4526 Regent St., Philadelphia, Pa. (47). **A**

*Du Bois, Patterson, 401 So. 40th St., Philadelphia, Pa. (33). 1887. **C H I**

DuBois, Wm. E. B., Professor of Economics and History, Atlanta University, Atlanta, Ga. (50). **I**

Dudgeon, H. R., M.D., Demonstrator of Surgery, School of Medicine, University of Texas, Galveston, Texas. (50). **F K**

*Dudley, Charles B., Drawer 334, Altoona, Pa. (23. 1882. **B C D**

Dudley, S. W., 15 Austin St., Westville, Conn. (50). **A D**

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*DUDLEY, WM. L., Vanderbilt University, Nashville, Tenn. (28). 1881. C
*Dudley, Prof. Wm. R., Stanford University, Cal. (29). 1883. G
Duffy, Rev. James S., 474 Sackett St., Brooklyn, N. Y. (43).
*Duggar, Benjamin Minge, U. S. Dept. Agriculture, Washington, D. C. (45). 1900. G
Duke, Frank Williamson, Professor of Mathematics, Hollins Institute, Hollins, Va. (50). A
*Dumble, E. T., 1708 Prairie Ave., Houston, Tex. (37). 1891. E
Duncan, Fred. N., Chemist, Georgetown, Texas. (50). C
Duncanson, Henry Bruce, Professor of Biology, State Normal School, Peru, Neb. (50). F
*Dunham, Edw. K., 338 E. 26th St., New York, N. Y. (30). 1890.
Dunlevy, Robert Baldwin, Prof. Kansas State Normal College, Winfield, Kansas. (50). C E
Dunn, Gano Sillick, Electrical Engineer, Crocker-Wheeler Company, Ampere, N. J. (50). D
Dunn, Louise Brisbin, Barnard College, Columbia University, New York, N. Y. (47). G
*Dunnington, Prof. F. P., University Station, Charlottesville, Va. (26.) 1880. C
*Dunstan, A. St. C., Professor of Electrical Engineering, Polytechnic Institute, Auburn, Ala. (50). 1901. B D
*Du Pont, Francis G., Wilmington, Del. (33). 1896. A B D
*Durand, Elias J., D.S., 402 Eddy St., Ithaca, N. Y. (41). 1899. G
Durand, John S., 146 Broadway, New York, N. Y. (49).
*Durand, W. F., Ph.D., Cornell University, Ithaca, N. Y. (37). 1890. B
*Durfee, William P., Ph.D., 639 Main St., Geneva, N. Y. (46). 1899. A
Dutton, Charles Frederic, Jr., 626 Franklin Ave., Cleveland, Ohio. (47).
Duval, Edmund P. R., 2006 University Ave., Austin, Texas. (50).
Duvel, Joseph W. T., Botanical Lab., Univ. of Michigan, Ann Arbor, Mich. (48). G
Dwight, Dr. Jonathan, Jr., 2 E. 34th St., New York, N. Y. (49).
*Dwight, Thomas, M.D., Harvard Medical School, Boston, Mass. (47). 1898. H K
*Dwight, Prof. William B., Vassar College, Poughkeepsie, N. Y. (30). 1882. E F
*Dyar, Harrison G., Ph.D., U. S. National Museum, Washington, D. C. (43). 1898.
Dysterud, E., Electrical Engineer, Monterey, Mexico. (50). D
*Earle, F. S., N.Y. Botanical Garden, Bronx Park, New York. (39). 1896. G
*Eastman, Charles Rochester, Museum Comp. Zoology, Cambridge, Mass. (41). 1896. E F
*Eastman, Prof. J. R., Andover, N. H. (26). 1879. A
*Eastwood, Miss Alice, Curator of Herbarium, California Academy of Sciences, San Francisco, Cal. (50). 1901. G.

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Eccles, David Charles, Chemist, Pullman, Wash. (50). **C**

*Eccles, Robert G., M.D., 191 Dean St., Brooklyn, N. Y. (31). 1894. **C F**

Eckles, C. H., Columbia, Mo. (50). **F**

*Eddy, Prof. H. T., Univ. of Minnesota, Minneapolis, Minn. (24). 1875. **A B D**

Edes, Robert Thaxter, M.D., 15 Greenough Ave., Jamaica Plain, Mass. (50). **F H K**

Edgar, Clinton G., 72 Jefferson Ave., Detroit, Mich. (46).

*Edison, Thomas A., Orange, N. J. (27). 1878. **B**

Edmonds, Richard H., President and Editor, "Manufacturers' Record," Baltimore, Md. (50). **D**

*Edwards, Prof. Charles Lincoln, Trinity College, Hartford, Conn. (49). 1900. **F**

Edwards, Prof. John W., Iowa Wesleyan University, Mt. Pleasant, Iowa. (48).

Ehrenfeld, Frederick, Ph.D., Instructor in Geology, University of Pennsylvania, Philadelphia, Pa. (50). **E**

Ehrhorn, Edward Macfarlane, County Entomologist, Santa Clara Co., Mountain View, Cal. (50). **F**

*Eichelberger, William Snyder, Ph.D., Nautical Almanac Office, U. S. Naval Observatory, Washington, D. C. (41). 1896. **A**

Eiesland, John, Ph.D., Professor of Mathematics, Thiel College, Greenville, Pa. (50). **A**

*Eigenmann, Carl H., Ph.D., Indiana University, Bloomington, Ind. (48). 1899. **F**

*Eimbeck, William, U. S. C. and G. Survey, Washington, D. C. (17). 1874. **A B D**

Eimer, August, 220 East 19th St., New York, N. Y. (50).

Elder, E. Waite, Instructor in Physics, High School, Denver, Colo. (50). **B**

Elftman, Arthur Hugo, Ph.D., Mining Engineer, 706 Globe Building, Minneapolis, Minn. (50). **E**

*Elkin, William L., Yale University Observatory, New Haven, Conn. (33). 1885. **A**

Elliott, George T., M.D., Cornell Medical College, 36 East 35th St., New York, N. Y. (50). **F K**

Ellis, Frederick W., M.D., Monson, Mass. (47). **B H**

Ellis, H. Bert, M.D., 243–246 Bradbury Block, Los Angeles, Cal. (50). **K**

Ellis, Robert W., Hurley, S. D. (50). **E**

*Elrod, Morton John, Professor of Biology, University of Montana, Missoula, Mont. (50). 1901. **F**

Ely, Sumner B., Chief Engineer American Sheet Steel Co., Vandergrift Building, Pittsburg, Pa. (50). **D**

*Ely, Theo. N., Chief of Motive Power, Pennsylvania R. R., Broad St. Station, Philadelphia, Pa. (29). 1886. **D**

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*Emerson, Prof. Benjamin K., Box 203, Amherst, Mass. (19). 1877. **E F**
*EMERSON, C. F., Box 499, Hanover, N. H. (22). 1874. **A B**
*Emery, Albert H., Stamford, Conn. (29). 1884. **B D**
Emery, Albert Hamilton, Jr., 312 Main St., Stamford, Conn. (47). **D**
Emmerton, Frederic Augustus, 9 Bratenahl Bldg., Cleveland, Ohio. (50). **I**
Emmons, Arthur B , Newport, R. I. (50). **E**
*EMMONS, S. F., U. S. Geol. Survey, Washington, D. C. (26). 1879. **E**
Enders, Howard Edwin, Professor of Biology, Lebanon Valley College, Annville, Pa. (50). **F G**
*Engelman, George J., M.D., 336 Beacon St., Boston, Mass. (25). 1875. **F H**
Engle, Wilber Dewight, Professor of Chemistry, University of Denver, University Park, Colo. (50). **C**
*Engler, Edmund Arthur, President Worcester Polytechnic Institute, Worcester, Mass. (50). 1901. **A**
English, George L., 812 Greenwich St., New York, N. Y. (36). **K**
English, William Thompson, M.D., Professor of Physical Diagnosis, Western University of Pennsylvania, Pittsburg, Pa. (50). **K**
ENO, A. F., 32 Fifth Avenue, New York, N. Y. (50).
Eno, John Chester, P. O. Box 1889, New York, N. Y. (49).
Epper, Rev. Frowin, O.S.B., Mt. Angel, Oregon. (50). **F**
Esmond, Darwin W., Newburgh, N. Y. (50.) **A I**
ESTES, DANA, Brookline, Mass. (29). **H I**
Evans, Alexander W., M.D., 12 High St., New Haven, Conn. (45). **G**
Evans, Henry Brown, 3009 Cambridge Place, Washington, D. C. (48). **A**
Evans, Samuel G., 211 Main St., Evansville, Ind. (39). **F**
Evans, William Lloyd, Colorado Springs, Colo. (46).
Evers, Edward, M.D., 1861 N. Market St., St. Louis, Mo. (28). **F H**
*Ewell, Ervin E., 1804 S St., Washington, D. C. (40). 1896. **C**
*Eyerman, John, "Oakhurst," Easton, Pa. (33). 1889. **C E**
Fabbri, E. G., Scarborough, N. Y. (49).
Faile, Thomas H., Murray Hill Hotel, New York, N. Y. (50).
*Fairbanks, Henry, Ph.D., St. Johnsbury, Vt. (14). 1874. **A B D**
Fairchild, B. T., P. O. Box 1120, New York, N. Y. (36).
*Fairchild, David Grandison, U. S. Dep't Agriculture, Washington, D. C. (47). 1898. **G**
*Fairchild, Prof. H. L., Univ. of Rochester, Rochester, N. Y. (28). 1883. **E F**
Falconer, William, Schenley Park, Pittsburg, Pa. (29).
Falding, Frederic J., Consulting Chemical Engineer, 52 Broadway, New York, N. Y. (50). **C**
Falk, Gustav, 24 East 81st St., New York, N. Y. (50).
*Fanning, John T., Consulting Engineer, Kasota Block, Minneapolis, Minn. (29). 1885. **D**

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*Fargis, Rev. Geo. A., S.J., Boston College, 761 Harrison Ave., Boston, Mass. (40). 1892.

*Farlow, Dr. W. G., 24 Quincy St., Cambridge, Mass. (20). 1875. G

Farnsworth, Philo J., M.D., Clinton, Iowa (50). K

Farquhar, Miss Helen, State Normal School, West Chester, Pa. (50). A B

*Farquhar, Henry, Census Office, Washington, D. C. (33). 1886. A B G I

Farr, Marcus S., Sc.D., N. Y. State Museum, Albany, N. Y. (49). E

Farrand, Livingston, M.D., Columbia University, New York, N. Y. (50). H

Farwell, Robert Benneson, C.E., 53 Monument Ave., Charlestown, Mass. (47). D

*Fassig, Oliver Lanard, Johns Hopkins University, Baltimore, Md. (46). 1899. B

Fast, Richard Ellsworth, Professor American History and Political Sciences, West Virginia University, Morgantown, W. Va. (50). I

Faught, John B., Professor of Mathematics, Northern State Normal School, Marquette, Mich. (50). A

Fawcett, Ezra, 233 Ely St., Alliance, Ohio. (48). B D

Fay, L. G., Naval Office, 20 Exchange Place, New York, N. Y. (50).

Fellows, Charles S., 925 Guaranty Building, Minneapolis, Minn. (34). F

Felt, Charles Wilson, 185 Austin St., Worcester, Mass. (47). I

*Felt, Ephraim Porter, Ph.D., State Entomologist, Albany, N. Y. (44). 1899. F

Fernald, F. A., Broadway and 117th St., New York, N. Y. (43). C

*Fernow, Bernhard E., Director N. Y. State College of Forestry, Cornell University, Ithaca, N. Y. (31). 1887. G I

Ferril, William C., Curator, State Historical and Natural History Society of Colorado, Denver, Colo. (50). E F G H I

Ferry, Dexter M., Jr., Seedsman, 1040 Woodward Ave., Detroit, Mich. (50). G

*Fessenden, Prof. Reginald A., U. S. Weather Bureau, Washington, D. C. (47.) 1899. A B

*Fewkes, Dr. J. Walter, Bureau of Amer. Ethnology, Washington, D. C. (48.) 1900. H

Field, Archelaus G., M.D., LL.B., Summit Place, Des Moines, Iowa. (48).

Field, George Wilton, 233 Medway St., Providence, R. I. (47).

Field, W. L. W., Milton, Mass. (47). F

Finch, John Wellington, State Geologist, Victor, Colo. (50). E

Findlay, Merlin C., Professor of Biology, Park College, Parkville, Mo. (50). F

*Fink, Prof. Bruce, Upper Iowa Univ., Fayette, Iowa. (45). 1899. G

*Firmstone, F., Easton, Pa. (33). 1887. D

Fischel, Washington E., M.D., 2647 Washington Ave., St. Louis, Mo. (50). F K

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Fischer, Louis Albert, U. S. C. and G. Survey, Washington, D.C. (47). **A B C**

*Fish, Pierre A., D.V.S., Ithaca, N. Y. (49). 1901. **K**

Fish, Walter Clark, Gen'l Elec. Co., Lynn, Mass. (50). **D**

Fishburne, Edward Bell, Jr., President Hoge Memorial Military Academy, Blackstone, Va. (51). **D**

Fisher, George E., 37 and 39 Wall St., New York, N. Y. (37).

Fisher, Irving, Ph.D., 460 Prospect St., New Haven, Conn. (50). 1901. **A I**

Fisher, Robert Jones, 614 F St., N. W., Washington, D. C. (50). **D**

Fisher, William Bowditch, General Manager, American Zinc, Lead and Smelting Co., Cartersville, Mo. (50). **C D E**

Fisk, Herbert F., Principal of the Academy, Northwestern University, Evanston, Ill. (50).

*Fiske, Prof. Thomas S., Columbia University, New York, N. Y. 1901. (50).

*Fitz, George W., MD., 483 Beacon St., Boston, Mass. (47). 1898. **H**

Flanders, Charles S., Franklin, Mass. (42). **E**

*Flather, John J., Professor of Mechanical Engineering, University of Minnesota, Minneapolis, Minn. (44). 1896. **D**

Fleming, John A., 1109 13th St., N. W., Washington, D. C. (48).

Fleming, Miss Mary A., The Oxford, 432 Pearl St., Buffalo, N.Y. (47). **E G**

Flemming, Dudley D., Gas Engineer, 249 Washington St., Jersey City, N. J. (50). **C D**

*Fletcher, Miss Alice C., Peabody Museum, Cambridge, Mass. (29). 1883. **H**

FLETCHER, ANDREW, 339 West 77th St., New York, N. Y. (50).

*Fletcher, James, Ph. D., Dominion Entomologist, Experimental Farm, Ottawa, Can. (31). 1883. **F**

*Fletcher, Robert, M.D., Army Medical Museum, Washington, D. C. (29). 1881. **F H**

*Flint, Albert S., Washburn Observatory, Madison, Wis. (30). 1887. **A**

*Flint, Austin, M.D., LL.D., Professor of Physiology, Cornell University Medical College, New York, N. Y. (50). 1901. **F K**

*Flint, James M., Surgeon U. S. N., The Portland, Washington, D. C. (28). 1882. **F**

Focke, Theodore M., Case School of Applied Science, Cleveland, Ohio, (44). **A B**

*Foley, Prof. Arthur Lee, Indiana University, Bloomington, Ind. (46). 1900. **B**

Folkmar, Daniel, D.S.S., D.U.Paris, care Mrs. Geo. Cuddeback, 5 Glen Etta St., Janesville, Wis. (46). **H**

Foote, James S., M.D., Creighton Medical College, Omaha, Neb. (50). **F K**

Foote, Warren M., 311 N. 33d St., Philadelphia, Pa. (50). **C**

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Forbes, Robert H., Professor of Chemistry, University of Arizona, Tucson, Arizona. (50). **C**

Ford, James B., 4 East 43d St., New York, N. Y. (49).

Fort, I. A., U. P. Land Agent, North Platte, Neb. (51).

Foster, Macomb G., P. O. Box 1120, New York, N. Y. (49).

Foster, William, Newburgh, N. Y. (50). **I**

Fowler, Edwin H., U. S. C. and G. Survey, Washington, D. C. (47).

*Fox, Oscar C., U. S. Patent Office, Washington, D. C. (36). 1891. **A B D**

Fox, William, Asst. Professor Physics, College of the City of New York, New York, N. Y. (50). **B D**

Fraenkel, Joseph, M.D., 46 East 75th St., New York, N. Y. (50). **K**

Francis, Charles Kenworthy, Ph.B., Adjunct Prof. of Chemistry, Ga. School of Technology, Atlanta, Ga. (50). **C**

Francisco, M. Judson, 49 Merchants Row, Rutland, Vt. (50). **I**

*Frankforter, George B., University of Minnesota, Minneapolis, Minn. (43). 1901. **C**

Frankland, Frederick W., 346 Broadway, New York, N. Y. (50).

*Franklin, Mrs. C. Ladd, 1507 Park Ave., Baltimore, Md. (47). 1899. **H**

*Franklin, Edward Curtis, Ph.D., Kansas State Univ., Lawrence, Kan. (47). 1900. **B G**

*Franklin, William S., Lehigh University, So. Bethlehem, Pa. (36). 1892. **B**

*Frazer, Dr. Persifor, Drexel Building, Room 1042, Philadelphia, Pa. (24). 1879. **C E**

*Frazier, Prof. B. W., Lehigh University, So. Bethlehem, Pa. (24). 1882. **C E**

*Frear, William, State College, Pa. (33). 1886. **C**

Frederick, Charles Warnock, U. S. Naval Observatory, Washington, D.C. (50). **A B C**

Freeborn, George C., M.D., 215 West 70th St., New York, N.Y. (50). **K**

*Freedman, William Horatio, Professor of Electrical Engineering, University of Vermont, Burlington, Vt. (50). 1901. **B D**

Freeman, Charles, Ph.D., Director of Clark Chemical Laboratory, Westminster College, New Wilmington, Pa. (50). **C**

Freeman, Prof. T. J. A., St. Peter's College, Grand St., Jersey City, N. J. (33). **B C**

*Freer, Prof. Paul C., Ann Arbor, Mich. (39). 1891. **C**

Freley, Jasper Warren, Wells College, Aurora, N. Y. (45). **B E**

*French, Prof. Thomas, Jr., 114 N. Ingalls St., Ann Arbor, Mich. (30). 1883. **B**

French, Wm. H., Oak Park, Ill. (47). **I**

Fretz, John Edgar, M.D., 112 North 3rd St., Easton, Pa. (46). **F G H**

Frick, Prof. John H., Central Wesleyan College, Warrenton, Mo. (27). **A B E F**

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*Fries, Dr. Harold H., 92 Reade St., New York, N. Y. (40). 1898. C

FRISBIE, J. F., M.D., Box 455, Newton, Mass. (29). E H

*Frisby, Prof. Edgar, U. S. Naval Observatory, Washington, D. C. (28). 1880. A

*Frost, Edwin Brant, Yerkes Observatory, Williams Bay, Wis. (38). 1890. A B

Frost, George H., C.E., Editor of *Engineering News*, 220 Broadway, New York, N. Y. (50). B D

Frost, Miss Lucy Ames, 35 Robinson St., Dorchester, Mass. (47). B

Frost, William Dodge, Instructor in Bacteriology, University of Wisconsin, Madison, Wis. (50). F

FROTHINGHAM, MRS. FREDERICK, 152 Pautucket St., Lowell, Mass. (31). A F I

Fuller, Arthur Levens, Brunner, Kans. (50). C

Fuller, Charles Gordon, M.D., 100 State St., Chicago, Ill. (35). F

Fuller, George W., 100 William St., New York, N. Y. (50).

*Fuller, Prof. Homer T., President Drury College, Springfield, Mo. (35). 1891. C E

*Fuller, Melville W., LL.D., Chief Justice U. S. Supreme Court, 1800 Massachusetts Ave., Washington, D. C. (40). 1901. I

FULLER, MYRON L., Assistant Geologist, U. S. Geological Survey, Washington, D. C. (50). E

Fullmer, Edward Lawrence, Prof. of Natural Science, Dakota Univ., Mitchell, S. D. (50). F

*Fulton, Robert B., Chancellor Univ. of Mississippi, University, Miss. (21). 1887. A B

Fulton, Weston Miller, Instructor in Meteorology, University of Tennessee, Knoxville, Tenn. (50). B

*Furness, Miss Caroline E., Vassar College Observatory, Poughkeepsie, N. Y. (47). 1899. A

Gable, George D., Ph.D., Parsons College, Fairfield, Iowa. (40). A B

*Gage, Prof. Simon Henry, Cornell University, Ithaca, N. Y. (28). 1881. F

*Gage, Mrs. S. H., Ithaca, N. Y. (48). 1900. F

Gager, C. Stuart, Professor of Biologic Science, New York State Normal College, Albany, N. Y. (50). F G

Gaither, George R., ex-Attorney General of Maryland, 1310 Continental Bldg., Baltimore, Md. (50). I

*Galbraith, Prof. John, School of Practical Science, Toronto, Can. (38). 1889. D

*Galloway, B. T., U. S. Dep't Agriculture, Washngton, D. C. (37). 1890 G

*Galloway, Thomas Walton, Professor of Biology, Missouri Valley College, Marshall, Mo. (45). 1901. F G

*Ganong, Wm. F., Smith College, Northampton, Mass. (49). 1900. G

Gardiner, Rev. Frederic, Jr., Yeates School, Lancaster, Pa. (47). F H

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Gardner, Rev. Corliss B., Ripley, N. Y. (29). **A B I**
Gardner, Geo. Clinton, Mills Bldg., 35 Wall St., New York, N. Y. (50).
Garnier, Madame Laure Russell, The Castle, Tarrytown, N. Y. (40).
Garrett, Albert O., Fort Scott, Kansas. (50). **I**
Garrett, Hon. John W., 11 South St., Baltimore, Md. (50).
Garriott, Edward B., U. S. Weather Bureau, Washington, D. C. (49).
Garver, John A, 44 Wall St., New York, N. Y. (49).
Garvin, John B., Instructor in Chemistry, High School District No. 1, Denver, Colo. (50). **C**
Gates, Fanny Cook, Instructor in Physics, Woman's College, Baltimore, Md. (50). **A B**
Gault, Franklin B., 602 N. I St., Tacoma, Wash. (43).
Gause, Fred Taylor, Manager Standard Oil Co. of New York, T. and B. Dep't, Yokohama, Japan. (40).
Gauss, Robert, Editor *Denver Republican*, Denver, Colo. (50). **I**
Geisler, Joseph F., New York Mercantile Exchange, New York, N. Y. (50).
*GENTH, FRED. A., 103 N. Front St., Philadelphia, Pa. (32). 1900. **C E**
*Genthe, Karl Wilhelm, Ph.D., Instructor in Zoology, Trinity College, Hartford, Conn. (50). 1901. **F**
*Germann, George B., 90 Norman Ave., Brooklyn, N. Y. 49. 1901. **A**
Getman, Frederick H., Johns Hopkins University, Baltimore, Md. (45). **B**
*Gibbs, Prof. J. Willard, New Haven, Conn. (33). 1885. **B**
*GIBBS, PROF. WOLCOTT, Newport, R. I. (1). 1896. **B C**
*Gies, William J., College of Physicians and Surgeons, 437 West 59th St., New York, N. Y. (49). 1901. **C**
Giffin, Frank Albee, Boulder, Colo. (50). **A B**
Gifford, John Clayton, Asst. Professor of Forestry, New York State College of Forestry, Ithaca, N. Y. (50). **G**
Gilbert, Charles B., Educator, 106 Brunswick St., Rochester, N. Y. (50). **I**
*GILBERT, G. K., U. S. Geol. Survey, Washington, D. C. (18). 1874. **E**
*Gill, Adam Capen, Cornell University, Ithaca, N. Y. (38). 1894. **E**
*Gill, Augustus Herman, Mass. Institute Technology, Boston, Mass. (44). 1896. **C**
*Gill, Dr. Theodore, Cosmos Club, Washington, D. C. (17). 1874. **F**
*Gillette, Clarence P., Professor of Zoology, Agricultural College, Fort Collins, Colo. (50). 1901. **F**
Gilman, Charles Edward, Stanford University, Cal. (51). **E**
*Gilman, Daniel C., Johns Hopkins University, Baltimore, Md. (10). 1875. **E H**
Girty, George H., Ph.D., U. S. Geol. Survey, Washington, D. C. (48).
Glaser, C., 21 S. Gay St., Baltimore, Md. (49).
Gleason, H. Allan, Asst. in Botany, Univ. of Illinois, Champaign, Ill.

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Gleason, W. Stanton, M.D., 143 Grand St., Newburgh, N. Y. (50). **F K**

Glenn, L. C., Ph.D., Professor of Geology, Vanderbilt University, Nashville, Tenn. (50). **E**

*Glenn, William, 1348 Block St., Baltimore, Md. (33). 1893. **C**

GLENNY, WILLIAM H., Buffalo, N. Y. (25).

Godkin, Mrs. E. L., 36 W. 10th St., New York, N. Y. (49).

*Goessmann, Prof. C. A., Mass. Agric. College, Amherst, Mass. (18). 1875. **C**

*Goff, E. S., 1113 University Ave., Madison, Wis. (35). 1889.

Gold, Rev. Dr. James Douglas, Covington, Ohio. (50). **I**

*Gold, Theodore S., West Cornwall, Conn. (4). 1887. **B C**

*Golden, Miss Katherine E., Purdue University, Lafayette, Ind. (42). 1897. **G**

*Goldschmidt, S. A., Ph.D., 43 Sedgwick St., Brooklyn, N. Y. (24). 1880. **B C E**

*Goldsmith, Edw., 658 N. 10th St., Philadelphia, Pa. (29). 1892. **B C**

Goldthwaite, Miss Nellie Esther, Mount Holyoke College, So. Hadley, Mass. (47). **C**

*Gooch, Frank A., Yale University, New Haven, Conn. (25). 1880. **C**

*Goodale, Prof. George Lincoln, Botanic Gardens, Cambridge, Mass. (18). 1875. **G**

Goodale, Joseph Lincoln, M.D., 397 Beacon St., Boston, Mass. (50). **F K**

Goodnow, Henry R., 95 Riverside Drive, New York, N. Y. (32). **B**

*Goodspeed, Arthur Willis, Ph.D., Dep't Physics, University of Pennsylvania, Philadelphia, Pa. (47). 1898. **A B**

Goodwin, Elmer Forrest, Principal and Prof. Physics and Chemistry Concord Branch, West Virginia State Normal School, Athens, W. Va. (50). **B C**

*Goodwin, Harry M., Professor of Physical Chemistry, Mass. Institute Technology, Boston, Mass. (47). 1901. **B**

Goodyear, William H., Museum of Brooklyn Institute of Arts and Sciences, Eastern Parkway, Brooklyn, N. Y. (43).

Gordon, Clarence M., Ph.D., Centre College, Danville, Ky. (48). **A B C**

Gordon, Reginald, Columbia University, New York, N. Y. (50).

Gordon, Robert H., Cumberland, Md. (48). **E F**

*Goss, Prof. Wm. F. M., Lafayette, Ind. (39). 1896.

Goucher, John Franklin, President of The Woman's College, Baltimore, Md. (50).

Goulding, Herbert Jay, 917 Mary St., Ann Arbor, Mich. (47). **A B**

Gouldy, Miss Jennie A., Newburgh, N. Y. (50). **I**

Grabill, H. P., 1004 Enas Ave., Des Moines, Iowa. (50). **C**

Graef, Edw. L., 58 Court St., Brooklyn, N. Y. (28). **F**

Graham, James Chandler, Chemist, Phillips Academy, Andover, Mass. (50). **C**

Graham, R. D., 35 Wall St., New York, N. Y. (50).

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Granbery, Julian Hastings, Asst. Engineer Manhattan R. R. Co., of New York City, 670 Pennsylvania Ave., Elizabeth, N. J. (50). **D**

Granger, Arthur O., Cartersville, Ga. (50). **A B**

Grant, U. S., Northwestern University, Evanstou, Ill. (50). **G**

Granville, William Anthony, Ph.D., Instructor in Mathematics, Yale University, New Haven, Conn. (50). **A**

*Gratacap, L. P., 77th St. and 8th Ave., New York, N. Y. (27). 1884. **C E F**

*Gray, Prof. Thomas, Terre Haute, Ind. (38). 1889. **D**

Greef, Ernest F., 37 W. 88th St., New York, N. Y. (49).

*Green, Arthur L., Purdue University, Lafayette, Ind. (33). 1888. **C**

*Greene, Charles Wilson, Ph.D., Professor of Physiology, State University of Missouri, Columbia, Mo. (50). 1901. **F K**

Green, Edgar Moore, M.D., Easton, Pa. (36). **C G H**

Greene, Prof. Edward Lee, Catholic University of America, Washington, D. C. (42). **G**

Greene, G. K., 127 W. Market St., New Albany, Ind. (38).

Green, Horace, care "Sunday Journal," 15 Spruce St., New York, N. Y. (50).

Green, Miss Isabella M., 111 Union Place, Akron, Ohio. (47).

Greene, J. Evarts, 98 Lincoln St., Worcester, Mass. (47). **I**

Greene, Jacob L., President Mut. Life Insurance Co., Hartford, Conn. (23).

Green, Milbrey, M.D., 567 Columbus Ave., Boston, Mass. (29).

Greenalch, Wallace, Deputy City Engineer, Albany, N. Y. (51). **D**

Greenleaf, Robert Willard, M.D., 561 Boylston St., Boston, Mass. (47).

*Greenman, Jesse M., 875 Doan St., Cleveland, Ohio. (47). 1899. **G**

Greenough, Charles Pelham, Attorney-at-law, 39 Court St., Boston, Mass. (50). **I**

Greenough, John, 31 W. 35th St., New York, N. Y. (49).

Gregg, William H., M.D., Port Chester, N. Y. (49).

Gregory, Miss Emily Ray, Ph.D., Professor of Biology, Wells College, Aurora, N. Y. (50). **F**

Gregory, Herbert E., Yale University, New Haven, Conn. (50). **E**

Greiner, Bert H., Culver Military Acad., Culver, Ind. (48).

Griffin, Gen. Eugene, First Vice-President, General Electric Co., 44 Broad St., New York, N. Y. (50). **D**

Griffin, Mrs. Margaret L., Keene, N. H. (50). **E G**

Griffith, C. J., Instructor in Dairying, Agricultural College, Fort Collins, Colo. (50). **F**

Griffith, Daniel J., 21 W. 56th St., New York, N. Y. (49).

Griffith, Herbert Eugene, Professor of Chemistry, Knox College, Galesburg, Ill. (50). **C**

Griffith, John Howell, Professor of Mathematics and Civil Engineering, Clarkson School of Technology, Potsdam, N. Y. (50). **D**

Griffith, Miss Mary Dechert, 3914 Walnut St., Philadelphia, Pa. (47). **B C**

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Griffith, W. W., Instructor in Physics, State University, Columbia, **Mo.** (50). **B**

Griffiths, David, Div. Agrostology, U. S. Dept. Agriculture, Washington, D. C. (49) **G**

*Grimes, James Stanley, 1422 Wesley Ave., Evanston, Ill. (17). 1874. **E H**

*Grindley, Dr. Harry Sands, Associate Professor of Chemistry, University of Illinois, Urbana, Ill. (46). 1898. **C**

*Grinnell, George Bird, 346 Broadway, New York, N. Y. (25). 1885. **E F**

Griswold, Clifford S., Head of Dept. of Physics, Groton School, Groton, Mass. (50). **B**

*Griswold, Leon Stacy, 238 Boston St., Dorchester, Mass. (38). 1893. **E**

Grosvenor, Gilbert H., "National Geographic Magazine," Corcoran Bldg., Washington, D. C. (48). **E I**

*Grout, Abel J., Boys' High School, Brooklyn, N. Y. (47). 1899. **G**

Grover, Frederick Orville, Professor of Botany, Oberlin College, Oberlin, Ohio. (50). **G**

*Gruener, Hippolyte, Adelbert College, Cleveland, Ohio. (44). 1898.

*Gulliver, F. P., St. Marks School, Southboro, Mass. (40). 1900. **E**

*Gunckel, Lewis W., 435 W. Second St., Dayton, Ohio. (41). 1897. **C**

*Guthe, Karl E., Ph.D., 904 S. State St., Ann Arbor, Mich. (45). 1897. **D**

Gutiérrez, Manuel R., Professor of Physics, Normal School, Calle de las Victimas num. 1, Jalapa, Vera Cruz, Mexico. (50). **B**

*Hagar, Stansbury, 179 Kingston Ave., Brooklyn, N. Y. (43). 1899.

*Hague, Arnold, U. S. Geol. Survey, Washington, D. C. (26). 1879. **E**

Hague, James D., 18 Wall St., New York, N. Y. (50).

Haight, Samuel C., Oakfield, N. Y. (49). **D**

Haight, Stephen S., C.E., 2085 Daly Ave., West Farms, New York, N. Y. (31). **D**

*Haines, Reuben, Haines and Chew Sts., Germantown, Philadelphia, Pa. (27). 1889. **B C**

*Hale, Albert C., Ph.D., 352A Hancock St., Brooklyn, N. Y. (29). 1886. **B C**

Hale, George D., 1059 Lake Ave., Rochester, N. Y. (41).

*Hale, George E., Yerkes Observatory, Williams Bay, Wis. (37). 1891. **A B C**

*Hale, William H., Ph.D., 40 First Place, Brooklyn, N. Y. (19). 1874. **A B C E F H I**

*Hall, Asaph, 12 Kirkland Place, Cambridge, Mass. (25). 1877. **A**

*Hall, Asaph, Jr., University of Michigan, Ann Arbor, Mich. (38). 1890. **A**

Hall, Charles M., Vice-President Pittsburg Reduction Co, Niagara Falls, N. Y. (50). **C.**

*Hall, C. W., Dean College of Engineering Met. and Mechan. Arts, University of Minnesota, Minneapolis, Minn. (28). 1883. **D E**

Hall, Edwin Bradford, Wellsville, N. Y. (50).

*Hall, Edwin H., 5 Avon St., Cambridge, Mass. (29). 1881. **B**

Hall, James P., 6 Poplar St., Brooklyn, N. Y. (40). **A B**

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Hall, Lyman, President of Georgia School of Technology, Atlanta, Ga. (50).

*Hall, Prof. Lyman B., Haverford College, Haverford, Pa. (31). 1884. C

Hall, Robert William, 2 Hillhouse Ave., New Haven, Conn. (50). F

Hall, William Shafer, Professor of Mining and Graphics, Lafayette College, Easton, Pa. (50). E

Halley, Robert Burns, Professor of Physics and Chemistry, Sam Houston Normal Institute, Huntsville, Texas. (50). B C

*Hallock, Albert P., Ph.D., 440 First Ave., New York, N. Y. (31). 1896. C

Hallock, Frank Kirkwood, M.D., Cromwell, Conn. (50). K

*Hallock, Dr. William, Columbia University, New York, N. Y. (40). 1893. B E

*Hallowell, Prof. Susan M., Wellesley College, Wellesley, Mass. (33). 1890. G

Halstead, Charles H., Board of Park Commissioners, Newburgh, N. Y. (50). I

*Halsted, Byron D., Rutgers College, New Brunswick, N. J. (29). 1883. G

*Halsted, George Bruce, M.D., 2407 Guadalupe St., Austin, Texas. (43). 1896.

Halsted, William Stewart, 1201 Eutaw Place, Baltimore, Md. (50).

Ham, Judson B., Teacher Natural Science, Vt. State Normal School, Johnson, Vermont. (50). F G

*Hamaker, John Irvin, Professor of Geology and Biology, Trinity College, Durham, N. C. (50). 1901. E F

*Hambach, Dr. G., 1319 Lami St., St. Louis, Mo. (26). 1891. E F

Hammatt, Clarence Sherman, Electrical and Mechanical Engineer, Jacksonville, Fla. (50). D

Hammel, Wm. C. A., Department of Physics, State Normal School, Baltimore, Md. (50). B F

Hammond, Mrs. Eliza F., 645 Jefferson Ave., Detroit, Mich. (46).

Hammond, George W., Hotel Hamilton, 260 Clarendon St., Boston, Mass. (47).

*Hammond, John Hays, Mining Engineer, Denver, Colo. (50). 1901. D E

Hammond, Mrs. John Hays, Denver, Colo. (50). H

*HANAMAN, C. E., Troy, N. Y. (19). 1883. F

Hard, Jas. M. B., Cordobanes 16, City of Mexico, Mexico. (50). C

*Harding, Everhart Percy, Instructor in Chemistry, University of Minnesota, Minneapolis, Minn. (50). 1901. C

Harding, Harry A., State Experiment Station, Geneva, N. Y. (48). G

Hardy, Edward R., 31 Allen St., Boston, Mass. (49.) I

*Hargitt, Prof. Charles W., Syracuse University, Syracuse, N. Y. (38). 1891. F

*HARKNESS, WILLIAM, U. S. Naval Observatory, Washington, D. C. (26). 1878. A B C D

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Harmon, Miss A. Maria, 171 McLaren St., Ottawa, Can. (31). **F H**
Harmon, Mrs. Israel, Springfield, Mass. (43).
Harnly, Henry Jacob, Ph.D., Professor of Biology, McPherson College, McPherson, Kan. (50). **F G**
*Harper, Charles A., Ph.D., 2139 Gilbert Ave., Cincinnati, Ohio. (40). 1899. **C**
*Harper, Henry Winston, M.D., The University of Texas, Austin, Texas. (45). 1899. **C**
Harrah, C. J., P. O. Box 1606, Philadelphia Pa. (48). **H**
*Harris, Abram Winegardner, Sc.D., Port Deposit, Md. (40). 1895. **C**
Harris, Mrs. Carolyn W., 125 St. Marks Ave., Brooklyn, N. Y. (50). **G**
*Harris, Prof. E. P., Amherst College, Amherst, Mass. (44). 1896.
Harris, Frederick S., Monticello, Kansas. (50). **E**
*Harris, Rollin Arthur, U. S. C. and G. Survey, Washington, D. C. (47). 1899. **A**
*Harris, Uriah R., Commander, U. S. N., Room 225, Custom House, St. Louis, Mo. (34). 1886. **A**
Harrison, Judge Lynde, 52 Hillhouse Ave., New Haven, Conn. (50). **I**
*Harrison, Robert Henry, M.D., Columbus, Texas. (50). **F K**
Hart, Charles A., Assistant to State Entomologist, Univ. of Illinois, Urbana, Ill. (51). **F**
*Hart, Edw., Ph.D., Lafayette College, Easton, Pa. (33). 1885. **C**
Hart, James Norris, Professor of Mathematics and Astronomy, Univ. of Maine, Orono, Maine. (51). **A**
Hart, Rev. Prof. Samuel, Berkeley Divinity School, Middletown, Conn. (22). **A**
Hartley, Frank, Principal of Allegheny County Academy, Cumberland, Md. (51). **E G**
Hartz, J. D. Aug., College Point, N. Y. (43).
Hartzell, Prof. J. Culver, Illinois Wesleyan Univ., Bloomington, Ill. (49). **E**
Harvey, Wm. Stocker, 119 So. 4th St., Philadelphia, Pa. (47).
*Haskell, Eugene E., Campeau Building, Detroit, Mich. (39). 1896. **A B D**
Hasslacher, Jacob, 100 William St., New York, N. Y. (50).
*Hastings, C. S., Sheffield Scientific School Yale University, New Haven, Conn. (25). 1878. **B**
Hastings, Edwin George, R. R. No. 2, Ashtabula, Ohio. (50). **F**
Hatcher, John Bell, Carnegie Museum, Pittsburg, Pa. (50). **E F**
Haupt, Gen. Lewis Muhlenberg, C.E., Consulting Engineer, 107 North 35th St., Philadelphia, Pa. (51). **D**
Havemeyer, John C., Yonkers, N. Y. (50).
Havemeyer, W. F., 32 Nassau St., New York, N. Y. (50).
Hawkins, J. Dawson, Colorado Springs, Colo. (50). **C D**
*Hay, Prof. Oliver Perry, Amer. Mus. Nat. History, Central Park, New York, N. Y. (49). 1901. **F**

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Hay, Prof. William P., 1316 Wallach Place, N. W., Washington, D. C. (49).

Hayes, George Washington, C.E., Lebanon, Pa. (51). **C D**

*Hayford, John F., C.E., U. S. C. and G. Survey, Washington, D. C. (46). 1898. **A B D**

Haynes, Prof. Arthur E., College of Engineering, University of Minnesota, Minneapolis, Minn. (45).

*Haynes, Prof. Henry W., 239 Beacon St., Boston, Mass. (28). 1884. **H**

Haynes, Miss Julia Anna, Emma Willard School, Troy, N. Y. (47). **F G**

Hays, B. Frank, Bensonhurst, N. Y. (49).

Hays, Charles I., care North Side High School, Denver, Colo. (50). **C G**

*Hays, Willet M., Professor of Agriculture, University of Minnesota, St. Anthony Park, Minn. (45). 1901. **G I**

Haywood, Prof. John, Otterbein University, Westerville, Ohio. (30). **A B**

Hazard, Daniel L., U. S. C. and G. Survey, Washington, D. (C). 48.

Hazard, R. G., Peace Dale, R. I. (50).

Hazen, Tracy Elliott, Director Fairbanks Museum, Saint Johnsbury, Vermont. (50). **G**

Head, W. R., 5467 Jefferson Ave., Hyde Park, Chicago, Ill. (38). **F**

Heald, Fred. DeForest, Ph.D., Professor of Biology, Parsons College, Fairfield, Iowa. (50). **F**

Heath, Harry E., Chief Engineer, The Eddy Electric Mfg. Co. Windsor, Conn. (50). **D**

Hebden, Edwin, Principal of Group A, Public Schools, 730 Colorado Ave., Baltimore, Md. (50). **E**

Hedgcock, George Grant, University of Nebraska, Lincoln, Neb. (50). **G**

Hedge, Frederic H., Public Library, Lawrence, Mass. (28). **F H**

*Hedrick, Henry B., Nautical Almanac Office, U. S. Naval Observatory, Washington, D. C. (40). 1896. **A**

Heller, Napoleon B., Professor of Mathematics and Astronomy, Fort Worth University, Fort Worth, Texas. (50). **A**

Hellick, Chauncey Graham, C.E., Ph.D., 203 Washington St., Chicago, Ill. (50). **D**

Henderson, Junius, 1933 13th St., Boulder, Colo. (50).

*Henderson, William Edward, Ph.D., Ohio State University, Columbus, O. (50). 1901. **C**

Henrich, Carl, Mining Engineer, Union Copper Mining Co., Gold Hill, N. C. (50). **A E I**

Hendricks, Henry H., 49 Cliff St., New York, N. Y. (30).

Hennen, Ray Vernon, C.E., care Carter Oil Co., Sistersville, W.Va. (50). **D**

*Henry, Alfred J., U. S. Weather Bureau, Washington, D. C. (49). 1901. **B**

Henry, Charles C., M.D., 56 Clark St., Brooklyn, N. Y. (43).

Hensel, Samuel Theodore, 801 E. Colfax Ave., Denver, Colo. (50). **C G**

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Hering, Daniel Webster, Professor of Physics, New York University, University Heights, New York, N. Y. (50). **B D**

*Hering, Rudolph, 100 William St., New York, N. Y. (33). 1885. **D E I**

Herr, Hiero B., Civil and Mining Engineer, 1246 Marquette Bldg., Chicago, Ill. (50). **E**

*Herrick, C. Judson, Dennison University, Granville, Ohio. (49). 1901. **F**

Herrick, Glenn W., Professor of Biology, A. & M. College, Agricultural College, Miss. (50). **F**

HERRMAN, MRS. ESTHER, 59 West 56th St., New York, N. Y.

Herrmann, Richard, Sec'y Iowa Institute of Science and Arts, Dubuque, Iowa. (50). **C E**

Herter, Christian A., M.D., 819 Madison Ave., New York, N. Y. (50) **K**

Herthel, Adolph, 1739 Waverly Place, St. Louis, Mo. (50). **I**

*Herty, Charles Holmes, Ph.D., Univ. of Georgia, Athens, Ga. (42). 1895. **C**

*Hervey, Rev. A. B., Bath, Me. (22). 1879. **F**

Herzog, Felix Benedict, Ph.D., President Herzog Teleseme Co., 51 West 24th St., New York, N. Y. (50). **D**

Hesse, Conrad E., U. S. Weather Bureau, Washington, D. C. (50). **A**

Heston, John W., President South Dakota Agricultural College, Brookings, S. D. (50). **I**

Hewett, Edgar L., President New Mexico Normal University, East Las Vegas, N. M. (50). **H**

Hewitt, Hon. Abram S., 9 Lexington Ave., New York, N. Y. (49).

Hewitt, Charles N., M.D., LL.D., Secretary State Board of Health, Red Wing, Minn. (50). **K**

HEXAMER, C. JOHN, C.E., 419 Walnut St., Philadelphia, Pa. (33). **B C**

Heyer, Wm. D., 523 South Broad St., Elizabeth, N. J. (33). **B D**

Higdon, John Clark, 605 Union Trust Bldg., St. Louis, Mo. (50). **B D I**

Higginson, James J., 16 E. 41st St., New York, N. Y. (49).

Higginson, John A., 260 Clarendon St., Boston, Mass. (50).

Higley, Hon. Warren, 68 West 40th St., New York, N. Y. (43).

Hildreth, John L., 14 Garden St., Cambridge, Mass. (50).

*Hilgard, Prof. E. W., Univ. of California, Berkeley, Cal. (11). 1874. **B C E**

Hill, Bruce V., Grinnell, Iowa. (48). **B**

Hill, Ebenezer, Treasurer, Norwalk Iron Works, South Norwalk, Conn. (50). **D**

*Hill, George A., U. S. Naval Observatory, Washington, D.C. (47). 1900. **A**

*Hill, John Edward, Prof. of Civil Engineering, Brown University, Providence, R. I. (44). 1897. **D**

*Hill, Robert Thomas, U. S. Geol. Survey, Washington, D. C. (36). 1889. **E**

Hillig, Frederick J., S.J., Professor of Sciences, Canisius College, Buffalo, N. Y. (50).

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Hillkowitz, Wm., M.D., 704 Race St., Cincinnati, Ohio. (50). **C F I K**

*Hillyer, Homer W., Ph.D., Chemical Laboratory, Univ. of Wisconsin, Madison, Wis. (42). 1896. **C**

Hilton, William A., 435 Penn Ave., Waverly, N. Y. (49). **F**

*Himes, Prof. Charles F., Carlisle, Pa. (29). 1882. **B C**

Hine, James S., Ohio State Univ., Columbus, Ohio. (48). **F**

Hinman, William K., 10 W. 30th St., New York, N. Y. (49).

*Hinrichs, Dr. Gustavus, 4106 Shenandoah Ave., St. Louis, Mo. (17). 1874. **B C**

Hinton, John H., M.D., 41 W. 32nd St., New York, N. Y. (29). **F H**

Hirschberg, Michael H., Judge of Supreme Court, State of New York, Newburgh, N. Y. (50). **I**

Hiss, P. Hanson, M.D., 28 Washington Square, N., New York, N.Y. (49). **K**

*Hitchcock, Albert Spear, Div. Agrostology, U. S. Dep't Agriculture, Washington, D. C. (39). 1892. **G**

Hitchcock, Miss Caroline Judson, Teacher in High School, Meriden, Conn. (50). **B E**

*Hitchcock, Charles H., Hanover, N. H. (11). 1874. **E**

Hitchcock, Embury A., 380 W. Eighth Ave., Columbus, Ohio (48). **D**

Hitchcock, Miss Fanny R. M., 4038 Walnut St., Philadelphia, Pa. (35). **F**

*Hitchcock, Frank H., Chief Section Foreign Markets, U. S. Dep't Agriculture, Washington, D. C. (49). 1901. **I**

*Hitchcock, Romyn, Room 1804, 20 Broad St., New York, N. Y. (47). 1898. **B C**

*Hoadley, George A., Swarthmore College, Swarthmore, Pa. (40). 1900.

Hobbs, Prof. Perry L., Western Reserve Medical College, Cleveland, Ohio. (41). **C**

*Hobbs, William Herbert, Ph.D., Madison, Wis. (41). 1893. **E**

Hodge, Frederick Humbert, Professor of Mathematics, Bethel College, Russellville, Ky. (50). **A**

Hodge, James M., Big Stone Gap, Va. (29). **D E**

Hodges, Miss Julia, 217 W. 44th St., New York, N. Y. (36). **E F H**

Hodges, Thomas Edward, Professor of Physics, W. Va. State University, Morgantown, W. Va. (50). **B**

*Hodgkins, Prof. H. L., Columbian University, Washington, D. C. (40). 1896. **A B**

Hoe, Mrs. R., Jr., 11 E. 36th St., New York, N. Y. (36).

Hoe, Mrs. Richard M., 11 E. 71st St., New York, N. Y. (36).

Hoffman, Christian B., Enterprise, Kansas. (50). **D H**

Hoffman, Very Rev. Eugene Aug., D.D., 1 Chelsea Square, New York, N. Y. (36).

*Hoffmann, Dr. Friedrich, Charlottenburg, Kant St. 125, Berlin, Germany (28). 1881. **C F**

Hogeboom, Miss Ellen C., Shelbyville, Ky. (46). **C**

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Holbrook, Percy, Gen'l. Mgr. Weber Ry. Joint Mfg. Co., 145 W. 69th St., New York, N. Y. (51). **D**

Holbrow, Herman L., Electrical Engineer, 112 Waverly Ave., Brooklyn, N. Y. (50). **D**

Holden, Edwin R., 13 E. 79th St., New York, N. Y. (49).

Holden, L. E., The Hollenden, Cleveland, Ohio. (32).

HOLDEN, MRS. L. E., The Hollenden, Cleveland, Ohio. (35).

Holferty, George M., Instructor in Botany, University of Illinois, Urbana, Ill. (50). **G**

*Holland, W. J., D.D., LL.D., Director Carnegie Museum, Pittsburg, Pa. (37). 1896. **F**

*Hollick, Arthur, N. Y. Botanical Garden, Bronx Park, New York, N. Y. (31). 1892. **E G**

Hollinshead, Warren H., Vanderbilt University, Nashville, Tenn. (37).

Hollister, John James, Mining Engineer, Gaviota, Santa Barbara Co., Cal. (50). **E**

Holmes, A. M., M.D., Jackson Block, Denver, Colo. (50). **F K**

Holmes, Dr. Christian R., 8–10 East Eighth St., Cincinnati, Ohio. (48).

Holmes, Frederic Harper, Instructor in Physics, Geography and Mathematics, State Normal School, Hyannis, Mass. (50). **A B E**

*Holmes, Prof. Joseph A., Chapel Hill, N. C. (33). 1887. **E F**

Holmes, Miss Mary S., 1331 Twelfth St., Philadelphia, Pa. (50). **E**

Holsinger, Samuel J., Special Agent, Interior Department, Phoenix, Arizona. (50). **H**

Holt, Edwin B., Trinity Court, Dartmouth St., Boston, Mass. (49).

Holt, Henry, 29 W. 23rd St., New York, N. Y. (29).

Holton, Henry D., M.D., Brattleboro, Vt. (44). **I**

Homer, Charels S., Valentine & Co., 245 Broadway, New York, N.Y. (29).

Hoobler, Bert Raymond, Cornell University, Ithaca, N. Y. (50). **F G**

Hood, William, 512 Van Ness Ave., San Francisco, Cal. (35). **D**

Hooker, Donald R., Chemist, 436 Orange St, New Haven, Conn. (50). **C K**

Hooker, Prof. Henrietta E., Mt. Holyoke College, South Hadley, Mass. (45). **G**

Hooper, Alcaeus, 710 Merchant's Bank, Baltimore, Md. (50). **I**

Hooper, Prof. Franklin W., Curator Brooklyn Institute, Brooklyn, N. Y. (43).

Hoover, William, Athens, Ohio. (49).

*Hopkins, A. D., Ph.D., State University, Morgantown, W. Va. (42). 1899. **F**

*Hopkins, Prof. Arthur John, Amherst College, Amherst, Mass. (44). 1900. **C**

Hopkins, George B., 25 West 48th St., New York, N. Y. (50).

Hopkins, George I., Manchester, N. H. (47). **A B**

*Hopkins, Grant S., Cornell University, Ithaca, N. Y. (41). 1900. **F**

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*Hopkins, Nevil Monroe, Asst. Professor of Chemistry, Columbian University, Washington, D. C. (48). 1901. C D

*Hopkins, Thomas Cramer, Syracuse University, Syracuse, N.Y. (38). 1898. E

Hormell, Prof. William G., Ohio Wesleyan Univ., Delaware, Ohio. (48). B

Hornung, Christian, Professor of Mathematics and Astronomy, Heidelberg University, Tiffin, Ohio. (50). A D

*Horsford, Miss Cornelia, 27 Craigie St., Cambridge, Mass. (46). 1897. H

Hortvet, Julius, State Chemist, 1521 University Ave., S. E., Minneapolis, Minn. (50). C

Hoskins, William, La Grange, Ill. (34). C

Hosmer, Sidney, E.E., Boston Electric Light Co., 3 Head Place, Boston, Mass. (50). D

Hotchkiss, Henry Stuart, Geologist, 55 Hillhouse Ave., New Haven, Conn. (50). E I

*Hough, Prof. G. W., Northwestern University, Evanston, Ill. (15). 1874. A B D

*Hough, Walter, U. S. National Museum, Washington, D. C. (38). 1890.

Houk, Mrs. Eliza P. T., 41 W. Second St., Dayton, Ohio. (48).

Houser, Gilbert L., Ph.D., Professor Animal Morphology and Physiology, University of Iowa, Iowa City, Iowa. (50). F K

*Hovey, Edmund O., Amer. Mus. Nat. History, Central Park, New York, N. Y. (36). 1895. C E

*Hovey, Rev. Horace C., 60 High St., Newburyport, Mass. (29). 1883. E H

*Howard, Curtis C., 97 Jefferson Ave., Columbus, Ohio. (38). 1892. C

*Howard, Leland O., Ph.D., Cosmos Club, Washington, D. C. (37). 1889. F

Howard, Mrs. Leland O., 1336 30th St., N.W., Washington, D. C. (49). H

Howard, Orson, M.D., Professor of Biology, University of Utah, Salt Lake City, Utah. (50). F K

*Howard, S. Francis, Professor of Chemistry, Mass. Agricultural College, Amherst, Mass. (50). 1901. C

*Howe, Charles S., Case School of Applied Science, Cleveland, Ohio. (34). 1891. A

*Howe, Henry M., Professor of Metallurgy, Columbia University, New York, N. Y. (50). 1901. D

*Howe, Herbert Alonzo, Director of the Chamberlin Observatory, University of Denver, University Park, Colo. (50). 1901. A

*Howe, Prof. Jas. Lewis, Washington and Lee University, Lexington, Va. (36). 1888. C

Howe, J. Morgan, M.D., 12 West 46th St., New York, N. Y. (50).

Howe, Marshall A., New York Botanical Garden, Bronx Park, New York, N. Y. (49).

*Howell, Edwin E., 612 17th St., N. W., Washington, D. C. (25). 1891. E

Howell, John W., Ballantine Parkway, Newark, N. J. (50).

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*Howell, William H., M.D., Professor of Physiology, Johns Hopkins University, Baltimore, Md. (50). 1901. **F K**

Howell, Wilson Stout, Sec'y Association of Edison Illuminating Companies, 14 Jay St., New York, N. Y. (50). **D**

Hower, Harry Sloan, Instructor in Physics, Case School of Applied Science, Cleveland, Ohio. (50). **B**

Howerth, Ira Woods, Instructor in Sociology, University of Chicago, Chicago, Ill. (50). **I**

Howland, Howard Newell, 116 S. 52nd Ave., Chicago, Ill. (50). **F**

Hoyt, Alfred M., 934 Fifth Ave., New York, N. Y. (50).

*Hrdlicka, Alës, M.D., Amer. Mus. Nat. Hist., 77th St. and Central Park, West, New York, N. Y. (46). 1897. **H**

Hubbard, Walter C., Coffee Exchange Bldg., New York, N. Y. (49).

*Huber, G. Carl, M.D., Junior Professor of Anatomy and Director of Histological Laboratory, University of Michigan, Ann Arbor, Mich. (50). 1901. **F K**

*Hudson, George H., Vice Principal, Dep't Natural Science, State Normal and Training School, Plattsburgh, N. Y. (31). 1901. **F**

Hull, Gordon Ferrie, Professor of Physics, Dartmouth College, Hanover, N. H. (50). **B**

Hume, Alfred, C. E., University, Miss. (39). **A**

Hummel, John A., Experiment Station, St. Anthony Park, Minn. (48).

Humphrey, Richard L., Testing Laboratory, City Hall, Philadelphia, Pa. (48). **D**

Humphreys, Alex. C., M.E., C.E., 31 Nassau St., New York, N. Y. (49).

Hun, Henry, M.D., Professor of Diseases of the Nervous System, Albany Medical College, Albany, N. Y. (50). **H K**

Hungerford, W. S., W. Ames & Co., Jersey City, N. J. (43). **D**

Hunsicker, George W., 141 N. 8th St., Allentown, Pa. (50). **C**

*Hunter, Andrew Frederick, Barrie, Ontario, Can. (38). 1896. **B H I**

*Hunter, Prof. Joseph Rufus, Richmond College, Richmond, Va. (45). 1899. **C**

Hunter, Samuel John, Associate Professor of Entomology, University of Kansas, Lawrence, Kansas. (50). **F**

Hunter, Walter David, Special Agent, U. S. Department Agriculture, Washington, D. C. (50). **F**

Huntington, Edward Vermilye, Williams College, Williamstown, Mass. (47). **A**

Huntley, D. B., Manager of the De Lamar Mining Co., Ltd., De Lamar, Idaho. (50). **D**

Hurd, E. O., Plainville, Ohio. (30). **E F**

Huxley, Henry Minor, Hotel Hunnewell, Newton, Mass. (48).

Hyams, Miss Isabel F., 26 Wales St., Dorchester, Mass. (47). **C**

*Hyatt, Prof. Alpheus, Natural History Society, Boston, Mass. (18). 1875. **E F**

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Hyde, B. T. Babbitt, 82 Washington St., New York, N. Y. (43). **D**
Hyde, Charles Gilman, 6336 Burbridge St., Germantown, Pa. (47). **D**
Hyde, Miss Edith E., U. S. Nat'l Museum, Washington, D. C. (50). **H I**
Hyde, E. Francis, 835 Fifth Ave., New York, N. Y. (43). **A**
Hyde, Miss Elizabeth Mead, 210 E. 18th St., New York, N. Y. (49). **H**
*Hyde, E. W., Station D, Cincinnati, Ohio. (25). 1881. **A**
Hyde, Frederick E., Jr., 20 W. 53d St., New York, N. Y. (43). **H**
Hyde, Frederick E., M.D., 20 W. 53rd St., New York, N. Y. (43). **E**
Hyde, Henry St. J., 210 E. 18th St., New York, N. Y. (49).
*Hyde, John, Statistician U. S. Dep't Agriculture, Washington, D. C. (47). 1898. **E I**
*Iddings, Joseph P., Univ. of Chicago, Chicago, Ill. (31). 1884. **E**
Iden, Thomas M., Professor of Chemistry and Physics, State Normal School, Emporia, Kansas. (50). **B C F**
*Iles, George, 5 Brunswick St., Montreal, Can. (31). 1898. **I**
Ingham, Wm. A., 320 Walnut St., Philadelphia, Pa. (33). **E**
Ingram, Edward Lovering, C.E., Expert aid, New York Navy Yard, New York, N. Y. (51). **A B C D**
Inslee, Mrs. Samuel, 50 W. 72nd St., New York, N. Y. (49).
Iorns, Martin J., Mount Vernon, Ia. (50). **C G**
*Ives, Frederick E., 2750 N. 11th St., Philadelphia, Pa. (44). 1898. **B**
*Jack, John G., Jamaica Plain, Mass. (31). 1890. **G**
*Jackson, Prof. Charles L., Harvard University, Cambridge, Mass. (44). 1895. **C**
*Jackson, Dr. Robert T., 33 Gloucester St., Boston, Mass. (37). 1890. **F**
Jacobs, Henry Barton, M.D., Instructor in Medicine, Johns Hopkins Medical School, Baltimore, Md. (50). **K**
Jacobs, Michael William, Harrisburg, Pa. (50). **I**
*Jacobus, David S., Stevens Institute, Hoboken, N. J. (36). 1889. **A B D**
*Jacoby, Harold, Columbia University, New York, N. Y. (38). 1891. **A**
*Jacoby, Henry S., Prof. of Bridge Engineering and Graphics, Cornell University, Ithaca, N. Y. (36). 1892. **D**
Jaffa, Myer Edward, Berkeley, Cal. (47).
James, Bushrod W., A.M., LL.D., M.D., N. E. cor. 18th and Green Sts., Philadelphia, Pa. (29). **F**
James, Charles C., Dep't Agriculture, Toronto, Can. (46). **I**
James, Mrs. Sarah S., 1517 O St., N. W., Washington, D. C. (49). **H I**
*Jaques, Capt. William H., Little Boarshead, N. H. (47). 1899. **D**
Jarvis, Samuel, M., 1 West 72nd St., New York, N. Y. (50).
*Jastrow, Dr. Joseph, Univ. of Wisconsin, Madison, Wis. (35). 1887. **F H**
*Jayne, Horace, 318 S. 19th St., Philadelphia, Pa. (29). 1884. **F H**
Jefferis, Wm. W., 442 Central Park, West, New York, N. Y. (33). **E**
*Jeffries, B. Joy, M.D., 15 Chestnut St., Boston, Mass. (29). 1881. **F H**
Jeffries, William A., 126 Beacon St., Boston, Mass. (47). **F**
Jelly, George Frederick, M.D., 69 Newbury St., Boston, Mass. (50). **F K**

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*Jenkins, Edw. H., Drawer 101, New Haven, Conn. (33). 1885. **C**

Jenks, A. E., Bureau of Ethnology, Washington, D. C. (50). **H**

*Jenks, Elisha T., Middleboro, Mass. (22). 1874. **D**

Jenks, Wm. H., Brookville, Pa. (38).

Jenks, William Johnson, Electrical Engineer, 120 Broadway, New York, N. Y. (50). **B D**

Jenney, Walter Proctor, E.M., Ph.D., Consulting Geologist and Mining Engineer, Kuntsford Hotel, Salt Lake City, Utah. (50). **E**

*Jennings, Walter L., Worcester Polytechnic Institute, Worcester, Mass. (45). 1898.

*Jesup, Prof. Henry G., Dartmouth College, Hanover, N. H. (36). 1891. **F**

Jesup, James R., 555 Fifth Ave., New York, N. Y. (50).

*Jesup, Morris K., 44 Pine St., New York, N. Y. (29). 1891. **I**

Jewell, Lewis E., Johns Hopkins University, Baltimore, Md. (49).

*Jewett, Prof. Frank Fanning, Oberlin College, Oberlin, Ohio. (47). 1899. **C**

Johns, Carl, Instructor in Biology, Bethany College, Lindsborg, Kans. (50). **F**

Johnson, Albert Lincoln, C. E., 606 Century Bldg., St. Louis, Mo. (51). **D**

Johnson, Frank Edgar, 747 Warburton Ave., Yonkers, N. Y. (50).

Johnson, Miss Isabel Louise, 467 Mass. Ave., Station A, Boston, Mass. (47). **E**

*Johnson, John B., Madison, Wis. (33). 1886. **D**

Johnson, Nels, Manistee, Mich. (41). **A B**

*Johnson, Otis C., 730 Thayer St., Ann Arbor, Mich. (34). 1886. **C**

Johnson, William Stone, Room 140, State House, Boston, Mass. (47). **D**

*Johnson, Willis Grant, 52 Lafayette Place, New York, N. Y. (47). 1901. **F**

Johnson, W. Smythe, Ph.D., Natchitoches, La. (49). **H**

Johnston, Thomas J., 66 Broadway, New York, N. Y. (50). **A B D**

Johnston, William A., Prince Bay, Borough of Richmond, N. Y. (50). **C**

Johnstone, William Bard, Assistant in Physics, Columbia University, New York, N. Y. (50). **B**

Johonnott, Edwin Sheldon, Ph.D., Rose Polytechnic Institute, Terre Haute, Ind. (50).

Jones, Charles C., M.D., Galveston, Texas (50). **K**

Jones, Clement Ross, Professor Mechanical Engineering, West Virginia University, Morgantown, W. Va. (50). **D**

*Jones, Frederick S., Professor of Physics, University of Minnesota, Minneapolis, Minn. (45). 1901. **B**

*Jones, Lewis R., Burlington, Vt. (41). 1894. **G**

Jones, Lynds, M.Sc., Instructor in Zoology, Oberlin College, Oberlin, Ohio (50). **F**

*Jones, Prof. Marcus E., Salt Lake City, Utah. (40). 1893. **G**

Jones, Philip Mills, M.D., Mills Bldg., San Francisco, Cal. (50).

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Jones, W. R. T., 1 East 39th St., New York, N. Y. (50).
*Jordan, Prof. David S., Stanford University, Cal. (31). 1883. F
*Jordan, Edwin Oakes, Ph.D., University of Chicago, Chicago, Ill. (50). 1901. K
Jordan, Whitman H., Director N. Y. Agric. Exper. Station, Geneva, N. Y. (45).
Josephs, Lyman C., Box 311, Newport, R. I. (47).
Juat, Francis, M.D., Aberdeen, N. C. (50). F K
*Judd, Prof. Charles H., University of Cincinnati, Cincinnati, Ohio. (49). 1901. H I
*Julien, Alexis A., N. Y. Academy of Sciences, New York, N. Y. (24). 1875. C E
Just, John A., Chemist, 116 West Castle St., Syracuse, N. Y. (50). C
Kahl, Paul Hugo Isidor, Curator of Entomological Museum, State University, Lawrence, Kan. (50). F
*Kahlenberg, Louis, Ph.D., 306 Lake St., Madison, Wis. (46). 1898. C
Kahn, Julius, 100 West 80th St., New York, N. Y. (50). C
Kammerer, Jacob Andrae, 87 Jameson Ave., Toronto, Canada. (50). C D
Kaufmann, Paul, M.D., Professor of Bacteriology, Pathology, and Hygiene, State University, Columbia, Mo. (50). K
Kay, James I., 426 Diamond St., Pittsburg, Pa. (51). D I
Kean, Mrs. Hamilton Fish, 25 East 37th St., New York, N. Y. (50).
Kearney, Thomas H., Jr., U. S. Dep't Agriculture, Washington, D. C. (47). G
Kedzie, John H., 1514 Ridge Ave., Evanston, Ill. (34). B
*Kedzie, Prof. Robert C., Agricultural College, Mich. (29). 1881. C
*Keep, Wm. J., Detroit, Mich. (37). 1897.
Keith, Prof. Marcia A., Mount Holyoke College, South Hadley, Mass. (46). B
Keilholtz, Pierre Otis, Consulting Engineer, Continental Trust Building, Baltimore, Md. (50). D
Keim, Edward Tudor, E.E., Supt. Am. Dist. Tel. Co., 1447 Lawrence St., Denver, Colo. (50). D F
Keller, Edward, Ph.D., Box 724, Baltimore, Md. (50). C D
*Kellerman, Prof. William A., Ohio State University, Columbus, Ohio (41). 1893. G
Kelley, John Harris, 315 N. Vine St., Nashville, Tenn. (44). C
Kelley, Walter S., Mining Engineer, Leadville, Colo. (50). D
Kellogg, John H., M.D., Battle Creek, Mich. (24). F
*Kellogg, Vernon Lyman, Professor of Entomology, Stanford University, California. (50). 1901. F
Kelly, John F., Ph.D., Consulting Electrical Engineer, 284 W. Housatonic St., Pittsfield, Mass. (50). D
Kelly, William, Mining Engineer, General Manager Penn. Iron Mining Co., Vulcan, Mich. (50). D E

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Kelsey, Harlan Page, 1150 Tremont Building, Boston, Mass. (47). G

Kelsey, James A., Agric. Exper't Station, New Brunswick, N. J. (49).

*Kemp, James F., School of Mines, Columbia University, New York, N. Y. (36). 1888. E

Kendall, Hugh F., Mining Engineer, The Interstate Mining Co., Virginia, Minn. (50). E

Kendig, Rev. A. B., D.D., 86 Vernon St., Brookline, Mass. (49).

*Kendrick, Prof. Arthur, Rose Polytechnic Institute, Terre Haute, Ind. (45). 1897. B

Kennedy, Frank Lowell, Instructor in Lawrence Scientific School, Harvard University, Cambridge, Mass. (50).

Kennedy, Dr. George Golding, Readville, Mass. (40). F G

KENNEDY, HARRIS, 284 Warren St., Roxbury, Mass. (40). E F

*Kennelly, Arthur Edwin, Sc.D., Electrical Engineer, Crozer Building, Philadelphia, Pa. (50). 1901. D

Kent, James Martin, Instructor in Steam and Electricity, Manual Training High School, Kansas City, Mo. (50). D E

Kent, Norton Adams, Ph.D., Yerkes Observatory, Williams Bay, Wis. (50). A

*Kent, William, Passaic, N. J. (26). 1881. D I

Kenyon, Oscar Curtis, Teacher of Physics, High School, Syracuse, N. Y. (50). B

Kepner, Harry V., Instructor in Chemistry, Manual Training High School, Denver, Colo. (50). C

Keppler, Rudolph, 28 W. 70th St., New York, N. Y. (49).

Kern, Josiah Quincy, Ph.D., 507 6th St., N.W., Washington, D.C. (40). I

Kern, Walter McCullough, Supt. City Schools, Columbus, Neb. (50) F G

*Kershner, Prof. Jefferson E., Lancaster, Pa. (29). 1883. A B

Kester, Fred. Edward, Ohio State University, Columbus, Ohio (48). B

Ketchum, Alexander P., 32 Mt. Morris Park, W., New York, N. Y. (49).

*Keyser, Cassius Jackson, Instructor in Mathematics, Columbia University, New York, N. Y. (50). 1901. A

Kimball, Albert B., M.E., Central High School, Springfield, Mass. (47). B

*Kimball, Arthur Lalanne, Professor of Physics, Amherst College, Amherst, Mass. (50). 1901. B

Kimball, Edwin Boyce, Mining Engineer, Oroville, Cal. (50). D

Kimball, S. I., Life Saving Service, U. S. Treasury Dep't, Washington, D. C. (49). I

Kindle, Dr. Edward M., Geologist, 109 Elm St., New Haven, Conn. (50). E

*Kinealy, John H., Washington University, St. Louis, Mo. (36). 1891. D

*King, A. F. A., M.D., 1315 Mass. Ave., N. W., Washington, D. C. (29). 1900. F H

King, Miss Ada M., 8 Ardmore St., Rochester, N. Y. (39). E I

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King, Cyrus A., Ph.D., Instructor in Botany, University of Indiana, Bloomington, Ind. (50). G

*King, F. H., Experiment Station, Madison, Wis. (32). 1892. E F

King, George B., Lawrence, Mass. (47).

*Kingsbury, Albert, Professor of Applied Mechanics, Worcester Polytechnic Institute, Worcester, Mass. (43). 1898. D

*Kingsbury, Benj. F., Ithaca, N. Y. (45). 1899. F

Kinner, Hugo, M.D., 1103 Rutger St., St. Louis, Mo. (21). F H

Kinney, Charles Noyes, Professor of Chemistry, Drake University, Des Moines, Iowa. (50). C

*Kinnicutt, Dr. Leonard P., 77 Elm St., Worcester, Mass. (28). 1883. C

Kinraid, Thomas Burton, 38 Spring Park Avenue, Jamaica Plain, Mass. (47).

Kinsley, Carl, Quadrangle Club, Chicago, Ill. (47). B

Kirk, Arthur, 910 Duquesne Way, Pittsburg, Pa. (50). E I

Kirk, Elliott W., Wesley Hall, Nashville, Tenn. (50). F G

Kirkpatrick, E. A., Fitchburg, Mass. (49). H I

Kirkwood, Joseph E., Instructor in Botany, Syracuse University, Syracuse, N. Y. (51). G

*Kirschmann, A., Ph.D., Toronto University, Toronto, Can. (50). 1901. H K

Kittredge, Miss H. A., North Andover, Mass. (37). F

Klepetko, Frank, Manager Reduction Works of Anaconda Copper Mining Co., Butte, Mont. (50). D

Klie, G. H. Chas., M.D., 5100 N. Broadway, St. Louis, Mo. (39). C F

*Klotz, Otto Julius, 437 Albert St., Ottawa, Can. (38). 1889.

Knapp, G. N., Stanton, Minn. (46). G H

Knight, Prof. Charles M., 219 S. Union St., Akron, Ohio. (29). B C

*Knipp, Charles Tobias, Indiana University, Bloomington, Ind. (46). 1900. B

Knox, Francis H., Electrical Engineer, Spartanburg, S. C. (50). D

Knox, Henry H., Mining Engineer, 110 East 23rd St., New York, N. Y. (50). D

Knox, S. L. Griswold, General Electric Co., Schenectady, N. Y. (50). D

*Kober, Geo. Martin, M.D., 1600 T St., N. W., Washington, D. C. (40). 1896. H

Koenig, Adolph, M.D., Editor "Penna. Medical Journal," 122 Ninth St., Pittsburg, Pa. (50). F G K

*Kofoid, Prof. Charles Atwood, University of California, Berkeley, Cal. (48). 1899. F

Kops, Julian de Bruyn, Civil Engineer, Savannah, Ga. (50). B D

Koues, Miss Elizabeth L., 282 W. 85th St., New York, N. Y. (41). I

*Kraemer, Prof. Henry, 145 N. 10th St., Philadelphia, Pa. (47). 1901. G

Kraus, Edward H., Syracuse University, Syracuse, N. Y. (50). E

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Krause, Otto H., Prospect Ave., Hackensack, N. J. (50).
Krécsy, Prof. Béla, VI Bulyovszky u. 22, Budapest, Hungary. (41). C
*Kremers, Prof. Edward, University of Wisconsin, Madison, Wis. (47). 1901. C
Kretz, Prof. Charles Henry, Asst. Professor Mechanical Engineering, La. State University and A. and M. College, Baton Rouge, La. (50). D
*Kroeber, A. L., Ph.D., Univ. of California, Berkeley, Cal. (47). 1901. H
Kuhne, F. W., 19 Court St., Fort Wayne, Ind. (38). A F
Kunhardt, Wheaton B., 1 Broadway, New York, N. Y. (49).
Kuntze, Dr. Otto, Villa Girola, San Remo, Italy. (49).
*Kunz, G. F., Messrs. Tiffany & Co., Union Square, New York, N. Y. (29). 1883. C E H
*Lachman, Arthur, Ph.D., Professor of Chemistry and Dean of College of Science and Engineering, University of Oregon, Eugene, Oregon. (50). 1901. C D
*Lacoe, Ralph D., 35 Exeter St., Pittston, Pa. (31). 1893. E F
*Ladd, Prof. E. F., Agricultural College, Fargo, No. Dakota. (36). 1889. C
La Fetra, Linnaeus Edford, M.D., 58 West 58th St., New York, N. Y. (50). F H K
*Laflamme, Prof. J. C. K., Laval University, Quebec, Can. (29). 1887. B E
*LaFlesche, Francis, 214 First St., S. E., Washington, D. C. (33). 1885. H
*Lamb, Daniel S., M.D., 800 10th St., N. W., Washington, D. C. (40). 1894. H
*Lambert, Preston A., 215 S. Center St., Bethlehem, Pa. (41). 1896. A
Lampard, Henry, 102 Shuter St., Montreal, Can. (40). C D E
Landis, W. W., Dickinson College, Carlisle, Pa. (50).
Landon, Francis C., Staatsburg-on-Hudson, N. Y. (50).
*Landreth, Olin H., Union College, Schenectady, N. Y. (28). 1883. D
Lane, Alfred C., State Geologist, Lansing, Mich. (50). E
Lane, Horace Manley, M.D., Caixa 14, S. Paulo, Brazil, South America, (46).
Lang, Prof. Henry R., Yale University, New Haven, Conn. (41). H
Lange, J. D., 220 W. 79th St., New York, N. Y. (49).
Lange, Philip A., Supt. Westinghouse Elec. and Mfg. Co., Pittsburg, Pa. (50). D
*Langenbeck, Karl, 27 Orchard St., Zanesville, Ohio. (39). 1896. C
*Langley, Prof. S. P., Smithsonian Institution, Washington, D. C. (18). 1874. A B
Langmann, Gustav, M.D., 121 W. 57th St., New York, N. Y. (36).
Langsdorf, Alexander Suss, Instructor in Physics and Electrical Engineering, Washington University, St. Louis, Mo. (50). B D
Lanneau, John Francis, Professor of Applied Mathematics and Astronomy, Wake Forest College, Wake Forest, N. C. (50). A B D
*Lanza, Prof. Gaetano, Mass. Institute Technology, Boston, Mass. (29). 1882. A B D

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La Rue, Wm. Gordon, North Freedom, Wis. (50). **D E**
Latimer, Thos. S., M.D., 211 W. Monument St., Baltimore, Md. (50). **F H K**
*Lattimore, Prof. S. A., University of Rochester, Rochester, N. Y. (15). 1874. **C**
Lauder, George, 7403 Penn. Avenue, Pittsburg, Pa. (50).
*Laudy, Louis H., Ph.D., School of Mines, Columbia University, New York, N. Y. (28). 1890. **C**
Lauman, George Nieman, Instructor in Horticulture, Cornell University, Ithaca, N. Y. (50). **G**
Law, Benedict W., 693 Lafayette Ave., Brooklyn, N. Y. (45). **E**
Lawrance, J. P. S., Past Assistant Engineer U. S. N., Navy Dep't, Washington, D. C. (35). **D**
Lawrence, A. E., 1 W. 81st St., New York, N. Y. (49).
Lawrence, Harry E., Univ. of Rochester, Rochester, N. Y. (44). **B**
Lawrence, James W., Professor of Mechanical Engineering, Agricultural College, Fort Collins, Colo. (50). **D**
Laws, Frank Arthur, Mass. Institute Technology, Boston, Mass. (47).
*Lawson, Andrew C., Professor of Geology and Mineralogy, University of California, Berkeley, Cal. (50). 1901. **E**
*Lazenby, Prof. Wm. R., Columbus, Ohio (30). 1882. **B I**
*Leach, Miss Mary F., Ann Arbor, Mich. (44). 1896. **C**
*Leaming, Edward, 437 West 59th St., New York, N. Y. (50). 1901. **C**
Leathers, W. S., Professor of Biology, University of Mississippi, University P. O., Miss. (50). **F**
Leavitt, Frank M., Mechanical Engineer, 258 Broadway, New York, N. Y. (51). **D**
Le Boutillier, Roberts, E. Washington Avenue, Germantown, Philadelphia, Pa. (47). **G**
*Le Brun, Mrs. Michel M., 8 Mountain Ave., S., Montclair, N. J. (35). 1892. **F**
*Ledoux, Albert R., Ph.D., 99 John St., New York, N. Y. (26). 1881. **C**
Lee, Francis Valentine T., Electrical Engineer, 31 and 33 New Montgomery Sts. San Francisco, Cal. (50). **D**
*Lee, Frederic S., Adjunct Professor of Physiology, Columbia University, New York, N. Y. (49). 1901. **K**
Lee, Waldemar, Passaic, N. J. (50).
Lee, William George, Harvard Medical School, Cambridge, Mass. (50). **H K**
Lee, Prof. Willis Thomas, Trinidad, Colo. (47). **E F**
Leeds, Morris E., 3221 North 17th St., Philadelphia, Pa. (50). **D**
*Lefavour, Prof. Henry, Williams College, Williamstown, Mass. (42). 1894.
Le Grand, Leroy, M.D., Graham, Texas. (50). **F K**

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*Lehmann, G. W., Ph.D., City Hall Annex, Baltimore, Md. (30). 1885. **B C**

Lehnartz, W., 173 S. Union St., Grand Rapids, Mich. (51).

Leiter, L. Z., 81 South Clark St., Chicago, Ill. (40).

Lemley, C. McC., Asst. Engineer, B. & O. R. R. Co., Philippi, W. Va. (51). **D**

Lemp, William J., cor. Cherokee and 2nd Carondelet Avenue, St. Louis, Mo. (27).

Lender, Mrs. Julia A., 2201 Lincoln Ave., Denver, Colo. (50). **A B**

*Lennon, William H., Brockport, N. Y. (31). 1894. **C G**

Leonard, John William, Editor of *Who's Who in America*, Wheaton, Ill. (50). **I**

Leonard, Percy Allan, Editor of *Ores and Metals*, P. O. Box 364, Denver, Colo. (50). **E**

Le Rossignol, James Edward, Ph.D., Professor of Economics, University of Denver, University Park, Colo. (50). **I**

*Lesley, Prof. J. Peter, P. O. Box 93, Milton, Mass. (2). 1874. **E**

Leslie, Miss Augusta, Newburgh, N. Y. (50). **I**

Letson, Miss Elizabeth J., 366 Mass. Ave., Buffalo, N. Y. (47).

*Leverett, Frank, Ann Arbor, Mich. (37). 1891. **E**

Levine, Edmund J., The Fiberloid Co., 638 Broadway, New York, N. Y. (49).

Lewis, Clarence McKenzie, care Chief Engineer, B. & O. R. R., Baltimore, Md. (47). **D**

Lewis, George Smith, 746 State St., Springfield, Mass. (44). **G**

*Lewis, Joseph Volney, Clemson College, S. C. (45). 1900. **C E**

*Libbey, Prof. William, Princeton, N. J. (29). 1887. **E F**

Lichthardt, G., Jr., 18th and M Sts., Sacramento, Cal. (50).

Lichty, Milton J., M.D., Cor. Genesee and Hough Ave., Cleveland, Ohio. (50). **F K**

*Lillie, Frank R., Professor of Zoology, University of Chicago, Chicago, Ill. (50). 1901. **F**

Lincoln, Paul Martyn, Electrical Engineer, care Niagara Falls Power Co., Niagara Falls, N. Y. (50). **D**

*Lindenkohl, Adolphus, U. S. C. and G. Survey, Washington, D. C. (40). 1898. **E**

Lindenkohl, Henry, U. S. C. and G. Survey, Washington, D. C. (47).

*Lindenthal, Gustav., C.E., 45 Cedar St., New York, N. Y. (37). 1891. **I**

Linder, Oliver A., 35 Clark St., Chicago, Ill. (49).

Lindsay, Alexander M., Rochester, N. Y. (41).

Lindsey, Edward, Warren, Pa. (48). **H**

*Ling, Charles Joseph, Instructor in Physics, Manual Training High School, Denver, Colo. (50). 1901. **A B**

*Linn, Alvin Frank, Ph.D., Professor of Chemistry, Wittenberg College, Springfield, Ohio. (50). 1901. **C**

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Linville, Henry R., 509 West 112th St., New York, N. Y. (49).
Littell, Frank B., U. S. Naval Observatory, Washington, D. C. (49).
Little, C. A., Analyst at Lorain Steel Works, Box 517, Elyria, Ohio. (50). **D**
Little, Henry P., Superintendent of Union Schools, Momence, Ill. (50). **B**
Livermore, Mrs. M. A. C., 59 Brewster St., Cambridge, Mass. (29). **F**
Lloyd, Andrew J., 310 Boylston St., Boston, Mass. (47). **B H**
*Lloyd, Francis E., Teachers' College, Columbia University, New York, N. Y. (48). 1901. **G**
*Lloyd, John Uri, Court and Plum Sts., Cincinnati, Ohio. (38). 1890. **C F**
Lobenstine, William C., 245 Central Park, W. New York, N. Y. (49).
Lockwood, Cornelius N., Teacher of Science, Newburgh Academy, Newburgh, N. Y. (50). **B E**
Lockwood, Edwin Hoyt, Asst. Prof. Mechanical Engineering, Yale University, New Haven, Conn. (50). **D**
Loeb, James, 27 Pine St., New York, N. Y. (49).
*Loeb, Morris, Ph.D., 118 W. 72d St., New York, N. Y. (36). 1889. **C**
*Loew, Dr. Oscar, Komaba, Tokyo, Japan. (49). 1900. **G**
Loewy, Benno, 206 and 208 Broadway, New York, N. Y. (41).
Logan, F. G., 2919 Prairie Ave., Chicago, Ill. (42). **H**
LOGAN, WALTER S., 27 William St., New York, N. Y. (36).
Lohmann, R. W., Transit Building, New York. (49).
Lomb, Adolph, P. O. Drawer 1033, Rochester, New York, N. Y. (41).
Lomb, Henry, P. O. Drawer 1033, Rochester, N. Y. (41).
Lomb, Henry C., P. O. Drawer 1033, Rochester, N. Y. (43).
*Long, Prof. John H., 2421 Dearborn St., Chicago, Ill. (41). 1895. **C**
Long, William Henry, Jr., Denton, Texas. (50).
*Longden, A. C., Ph.D., Professor of Physics, Knox College, Galesburg, Ill. (49). 1901. **B**
Loomis, Frederick B., Ph.D., Assistant in Zoology, Amherst College, Amherst, Mass. (50). **F**
Lord, Benjamin, 34 W. 28th St., New York, N. Y. (36).
*Lord, Prof. H. C., Ohio State University, Columbus, Ohio. (44). 1900. **A**
*Lord, Prof. Nat. W., State University, Columbus, Ohio (29). 1881. **C**
*LOUBAT, LE DUC DE, 47 rue Dumont d'Urville, Paris, France. (46). 1897. **H**
*Loud, Frank H., Colorado Springs, Colo. (29). 1890. **A B**
Louderback, George Davis, Professor of Geology, Nevada State University, Reno, Nev. (50). **E**
*Lough, J. E., New York University, Washington Square, New York, N. Y. (50). 1901. **I**
*Loughridge, Dr. R. H., Univ. of California, Berkeley, Cal. (21). 1874. **C E**
*Love, Edward G., 80 E. 55th St., New York, N. Y. (24). 1882. **C**
Lovejoy, J. R., Genl. Elec. Co., Schenectady, N. Y. (50). **D**
Low, A. A., Columbia Heights, Brooklyn, N. Y. (43). **A**
*Low, Seth, President Columbia University, New York, N. Y. (29). 1890.

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Lowber, Rev. James William, Ph.D., 113 East 18th St., Austin, Texas. (50). I

Lowell, Mrs. Charles Russell, 120 East 30th St., New York, N. Y. (49).

*Lowell, Percival, 53 State St., Boston, Mass. (36). 1896. A

Lowell, Russell C., 167 Ohio Ave., Providence, R. I. (51).

Lucas, Anthony F., Mining Engineer, 2034 I St., N. W., Washington, D. C. (50). D E

*Ludlow, Jacob Lott, C.E., 434 Summit St., Winston, N. C. (50). B D

Luebkert, Otto J. J., U. S. Dept. Agriculture, Washington, D. C. (50). G

Lufkin, Albert, Newton, Iowa. (31). D E

Lull, Richard S., Amherst, Mass. (43). F H

Lund, James, 142 Hawthorne St., Malden, Mass. (45).

Lundin, Carl A. R., care Messrs. Alvan Clark and Sons, Cambridgeport, Mass. (47). A

Luquer, Lea McIlvane, Columbia University, New York, N. Y. (49).

Luther, Miss Agnes Vinton, 917 Broad St., Newark, N. J. (47). E

*Lyford, Edwin F., Springfield, Mass. (33). 1896. B C H

*Lyle, Major David A., U. S. A., P. O. Box 1606, Philadelphia, Pa. (28). 1880. D

LYMAN, BENJ. SMITH, 708 Locust St., Philadelphia, Pa. (15). E

Lyman, Chester W., Assistant to President of International Paper Co., 30 Broad St., New York, N. Y. (50). I

Lyman, Henry H., 74 McTavish St., Montreal, Can. (29). E F

Lyman, James, Assist. Engineer, Gen'l Elec. Co., 1047 Monadnock Bldg., Chicago, Ill. (50). D

Lyons, Albert Brown, M.D., Consulting Chemist, 72 Brainard St., Detroit, Mich. (50). C K

*Mabery, Prof. C. F., Case School of Applied Science, Cleveland, Ohio (29). 1881. C

McAlpin, C. W., 11 East 90th St., New York, N. Y. (50).

Macbeth, George A., Trustee Carnegie Institute, Pittsburg, Pa. (50). D H

McBride, Hon. George Wickliffe, U. S. Comm'r La. Purchase Exposition, P. O. Box 173, Washington, D. C. (51). I

*Macbride, Thomas H., Iowa City, Iowa. (38). 1890. G

McCalley, Henry, Chief Assist. State Geologist, University, Ala. (50). E

McCartney, Dr. James H., Room 501 Granite Building, Rochester, N. Y. (41). A B

*McCauley, C. A. H., Colonel and Deputy Quartermaster-General, U.S.A., Manila, P. I. (29). 1881.

McClelland, James H., M.D., 5th and Wilkins Aves., Pittsburg, Pa. (50). F K

*McClintock, Emory, Morristown, N. J. (43). 1895. A

McCoy, Lucinus S., Whitten, Hardin Co., Iowa. (50). A

*McCreath, Andrew S., 223 Market St., Harrisburg, Pa. (33). 1889. C E

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*McCurdy, Charles W., Ph.D., Witherspoon Building, Philadelphia, Pa. (35). 1895. **E F**

*MacCurdy, George Grant, Ph.D., 237 Church St., New Haven, Conn. (48). 1900. **H**

McCurdy, Hansford M., Manual Training High School, Kansas City, Mo. (51). **F G**

Macdonald, Benjamin J., 296 Grand St., Newburgh, N. Y. (50). **I**

*McDonnell, Prof. Henry B., College Park, Md. (40). 1893. **C**

*MacDougal, Daniel T., N. Y. Botanical Garden, Bronx Park, New York, N. Y. (44). 1897. **G**

MacDougall, George R., 131 West 73rd St., New York, N. Y. (49).

*MacDougall, Robert, Ph.D., Sedgwick Park, University Heights, New York, N. Y. (49). 1901. **H K**

McFadden, L. H., Westerville, Ohio (32). **B C**

McFadden, Thomas Gilbert, Lebanon Valley Coll, Annville, Pa. (48). **C**

MacFarland, W. W., 22 William St., New York, N. Y. (49).

*Macfarlane, A., Lehigh University, S. Bethlehem, Pa. (34). 1886. **A B.**

Macfarlane, James R., President Academy of Science and Art, Pittsburg, Pa. (50). **E**

*Macfarlane, John M., Lansdowne, Pa. (41). 1899. **F G**

*McGee, Dr. Anita Newcomb, Bureau American Ethnology, Washington, D. C. (37). 1892. **H**

McGee, D. W., Farley, Iowa. (50). **E**

McGee, Miss Emma R., Box 197, Farley, Iowa. (33). **H**

*McGee, W J, Ph.D., Bureau Amer. Ethnology, Washington, D. C. (27). 1882. **E H**

*McGill, John T., Ph.D., Vanderbilt University, Nashville, Tenn. (36). 1888. **C**

McGinnis, W. H., 1020 Orange St., Youngstown, Ohio. (48).

*McGregory, Prof. J. F., Colgate University, Hamilton, N. Y. (35). 1892. **C**

MacIntyre, Miss Lucy, 303 West 74th St., New York, N. Y. (49)

Mack, Jacob W., 92 Liberty St., New York, N. Y. (49).

McKee, George C., care The Wm. Tod Co., Youngstown, Ohio. (48). **A B D**

McKelvy, William H., M.D., President Board of Education, 420 6th Ave., Pittsburg, Pa. (50). **I**

McKinney, Thomas Emory, Professor of Mathematics and Astronomy, Marietta College, Marietta, Ohio. (50). **A**

McLanahan, George William, 1601 21st St., N. W., Washington, D. C. (50).

McLaughlin, George Eyerman, M.D., 41 Crescent Ave., Jersey City, N. J. (47). **F H**

McLimont, Andrew Wingate, Electrical Engineer, Linares, Nuevo Leon, Mexico. (51). **D**

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*Macloskie, Prof. George, Princeton Univ., Princeton, N. J. (25). 1882. **F G**

McMahan, Charles Hays, E.M., Supt. Sombrerete Mining Co., Sombrerete, Zacatecas, Mexico. (50). **E**

McMahon, D. J., M.D., 239 East 21st St., New York, N. Y. (50). **K**

*McMahon, Prof. James, Cornell University, Ithaca, N. Y. (36). 1891. **A**

McMillan, Smith B., Signal, Ohio (37).

McMillin, Emerson, 40 Wall St., New York, N. Y. (37).

*McMurtrie, William, 100 William St., New York, N. Y. (22). 1874. **C**

*McNeill, Malcolm, Professor Mathematics and Astronomy, Lake Forest University, Lake Forest, Ill. (32). 1885. **A**

MacNeille, Perry Robinson, 155 William St., Orange, N. J. (51).

McNulty, Prof. John J., 17 Lexington Ave., New York, N. Y. (50).

*MacNutt, Barry, Lehigh University, So. Bethlehem, Pa. (47). 1900. **B**

*McPherson, Prof. Wm., Ohio State Univ., Columbus, Ohio (45). 1898. **C**

McPherson, William D., 58 Hartford St., So. Framingham, Mass. (47).

Macy, V. Everit, 68 Broad St., New York, N. Y. (49).

Magee, Louis J., Electrical Engineer, Grosse Quer Allee 1, Berlin, Germany. (50). **B D**

*Magie, Prof. Wm. Francis, Princeton University, Princeton, N. J. (35). 1887.

*Magruder, Wm. T., Ohio State Univ., Columbus, Ohio. (37). 1899.

Mahin, John William, Teacher in Manual Training High School, Denver, Colo. (50). **B C E**

Mallinckrodt, Edw., P. O. Sub-station A, St. Louis, Mo. (29). **C**

Mally, Charles William, Dept. Agric., Cape Town, So. Africa. (46).

Malm, John Lawrence, Marysville, Mont. (50). **C E**

*Maltby, Margaret E., Ph.D., 32 Eliot St., Jamaica Plain, Mass. (46). 1898.

Mangan, Daniel C., M.D., 95 Park Ave., Brooklyn, N. Y. (50). **K**

Mann, Albert, Ph.D., 2nd Ave., Belmar, N. J. (43). **F G**

*Mann, B. Pickman, 1918 Sunderland Place, Washington, D. C. (22). 1874. **F I**

Mann, Thomas Wm., 35 Hampden St., Holyoke, Mass. (44). **D**

Manning, Charles H., U. S. N., Manchester, N. H. (35). **D**

Manning, J. Woodward, 1150 Tremont Building, Boston, Mass. (47). **G**

Manning, Warren H., Brookline, Mass. (31). **E F H**

Manson, Marsden, Comm'r of Public Works, San Francisco, Cal. (51). **D**

Mapes, Charles Victor, 60 W. 40th St., New York, N. Y. (37). **C**

Marble, J. Russel, Worcester, Mass. (31). **C E**

Marble, Manton, Bedford, N. Y. 36).

Marble, Milton M., Instructor in Physics, Hillhouse High School, New Haven, Conn. (50). **B**

Marble, Miss Sarah, Woonsocket, R. I. (29). **C**

Marc, Theophilus M., 359 Produce Exchange, New York, N. Y. (49).

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*Marindin, Henry Louis, U. S. C. and G. Survey, Washington, D. C. (40). 1898. **E**

*Mark, Prof. E. H., Superintendent of Public Schools, Center and Walnut Sts., Louisville, Ky. (39). 1893. **B**

*Mark, Edward Laurens, Director Zoological Laboratory, Harvard University, Cambridge, Mass. (50). 1901. **F**

Markham, George Dickson, 4961 Berlin Ave., St. Louis, Mo. (50).

Marks, Louis B., 687 Broadway, New York, N. Y. (50).

Marks, William Dennis, C. E., The Art Club, Philadelphia, Pa. (50). **I**

Marlatt, Miss Abby L., Manual Training High School, Providence, R. I. (48).

*Marlatt, Charles L., U. S. Department Agriculture, Washington, D. C. (40). 1895. **F**

Marlow, Frank William, M.D., 200 Highland St., Syracuse, N. Y. (50). **H I K**

Marple, Charles A., 743 Third Ave., Louisville, Ky. (39). **B**

Marsden, Samuel, 1015 N. Leffengwell Ave., St. Louis, Mo. (27). **A D**

*Marsh, C. Dwight, Ripon, Wis. (34). 1893. **E F**

Marsters, Vernon, Indiana University, Bloomington, Ind. (49).

Marston, Edwin S., 291 Clinton Ave., Brooklyn, N. Y. (50).

*Martin, Artemas, Ph.D., LL.D., U. S. Coast and Geodetic Survey, Washington, D. C. (38). 1890. **A**

*Martin, Daniel S., 126 Macon St., Brooklyn, N. Y. (23). 1879. **E F**

Martin, F. W., Ph.D., Lynchburg, Va. (49).

Martin, William Lyon, Augusta, Ga. (50). **H**

Martin, W. R. H., 56 West 33rd St., New York, N. Y. (50).

*Marvin, C. F., U. S. Weather Bureau, Washington, D. C. (39). 1892. **B**

*Marvin, Frank O., Dean School of Engineering, University of Kansas, Lawrence, Kan. (35). 1894. **D**

Marvin, Harry Morton, 841 Broadway, New York, N. Y. (50). **D**

Marvin, Joseph B., M.D., LL.D., President Kentucky University, Louisville, Ky. (51). **I**

Marvin, Walter T., 36 Knox St., Cleveland, Ohio (50). **H I**

Mason, Miss Nellie M., Teacher of Science, Abbot Academy, Andover, Mass. (50). **B C**

*Mason, Otis T., U. S. National Museum, Washington, D. C. (25). 1877. **H**

*Mason, Dr. William P., Rensselaer Polytechnic Inst., Troy, N. Y. (31). 1886. **C**

Matas, Rudolph, M.D., Professor of Surgery, Tulane University, New Orleans, La. (50). **H K**

Mateer, Horace N., M.D., Wooster, Ohio (36). **E F**

Mathews, Miss Mary Elizabeth, Foster Hall, University of Chicago, Chicago, Ill. (41). **F**

Matlack, Charles, "Hidden Hearth," Matunuck, R. I. (27). **I**

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Matlack, Ellwood V., Sec'y and Mgr. Laclede Power Co., St. Louis, Mo. (50). D

Matthews, Rodolph, D.D.S., 128 N. Main St., Wichita, Kansas (50). C F

*Matthews, Dr. Washington, 1262 N. H. Ave., Washington, D. C. (37). 1888. H

Mattoon, A.M., Scott Observatory of Park College, Parkville, Mo. (47). A

Maxon, William R., U. S. National Museum, Washington, D. C. (49).

Maxwell, Fred. Baldwin, Ph.D., 308 Franklin Ave., River Forest, Oak Park P. O., Ill. (51). F

Maxwell, George H., Chairman Executive Committee, National Irrigation Association, 1827 Phelps Place, Washington, D, C. (50). E

Maxwell, Hu. Treasurer, Transallegheny Historical Society, Morgantown, W. Va. (50). E

*Mayer, Alfred Goldsborough, S.D., M.E., Museum Brooklyn Instutue, Eastern Parkway, Brooklyn, N. Y. (47). 1900. F

Maynard, George C., 1407 15th St., Washington, D. C. (35). B D

Maynard, Washburn, Captain U. S. N., Light House Board, Treasury Department, Washington, D. C. (33). B

Mead, Elwood, Consulting Civil Engineer, Washington, D. C. (51). D

Means, James, 196 Beacon St., Boston, Mass. (47).

*Mearns, Dr. Edgar A., U.S.A., Fort Adams, Newport, R. I. (49). 1901. K

Medsger, Oliver P., Jacob's Creek, Pa. (50). G

Meehan, Mrs. Thomas, Germantown, Pa. (29).

*Mees, Prof. Carl Leo, Rose Polytechnic Institute, Terre Haute, Ind. (24). 1876. B C

*Mell, Prof. P. H., Polytechnic Institute, Auburn, Ala. (39). 1895. E G

Mellor, Charles C., 319 Fifth Ave., Pittsburg, Pa. (38).

*Meltzer, S. J., M.D., 166 West 126th St., New York, N. Y. (49). 1901. K

*Mendenhall, Charles E., Ph.D., University of Wisconsin, Madison, Wis. (48). 1900. B

*Mendenhall, T. C., Worcester, Mass. (20). 1874. B

Menninger, Charles Frederic, M.D., 1251 Topeka Ave., Topeka, Kan. (50). G K

*Mercer, H. C., Doylestown, Pa. (41). 1893. H

Mercer, William Fairfield, Ph.D., Professor of Biology, Ohio University, Athens, Ohio. (50). F

*Merriam, Dr. C. Hart, U. S. Department Agriculture, Washington, D. C. (49). 1900. F

Merriam, John M., 517 Exchange Building, 53 State St., Boston, Mass. (48).

Merrill, Earle Abbott, 26 Cortlandt St., New York, N. Y. (50). D

Merrill, Elmer Drew., U. S. Dept. Agriculture, Washington, D. C. (50). G

*MERRILL, FREDERICK J. H., Ph.D., New York State Museum, Albany, N. Y. (35). 1887. E

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Merrill, Joseph Francis, Ph.D., Professor of Physics and Electrical Engineering, University of Utah, Salt Lake City, Utah. (50). **B D**

Merrill, Lucius Herbert, Professor of Biological Chemistry, University of Maine, Orono, Maine. (50). **C**

Merrill, Payson, 111 Broadway, New York, N. Y. (50).

MERRILL, MRS. WINIFRED EDGERTON, Ph.D., 268 State St., Albany, N. Y. (55). **A**

*Merriman, C. C., 1910 Surf St., Lake View, Chicago, Ill. (29). 1880. **F**

*Merriman, Mansfield, Lehigh University, So. Bethlehem, Pa. (32). 1885. **A D I**

*Merritt, Ernest, Cornell University, Ithaca, N. Y. (33). 1890. **B**

Merrow, Miss Harriet L., Rhode Island College of Agriculture & Mechanic Arts, Kingston, R. I. (44).

Merryweather, George N., 639 Forest Ave., Avondale, Cincinnati, O. (30). **F H**

*Metcalf, Maynard M., Ph.D., Professor of Biology, The Woman's College, Baltimore, Md. (50). 1901. **F**

METCALF, ORLANDO, 424 Telephone Building, Pittsburg, Pa. (35). **D**

*Metcalf, William, Pittsburg, Pa. (33). 1894. **D**

Metcalf, Wilmot V., Professor of Chemistry and Physics, Carleton, College, Northfield, Minn. (50). **B C**

Metcalfe, Captain Henry, 143 Liberty St., New York, N. Y. (50).

*Metzler, William H., Ph.D., Syracuse University, Syracuse, N. Y. (45). 1899. **A**

*Meyer, Max, Ph.D., Professor of Psychology, University of Missouri, Columbia, Mo. (49). 1901. **H I**

*Mezes, Sidney Edward, Professor of Philosophy, University of Texas, Austin, Texas. (50). 1901. **I**

*Michael, Mrs. Helen Abbott, 35 West Cedar St., Boston, Mass. (33). 1885. **C F**

*Michelson, Prof. A. A., Chicago University, Chicago, Ill. (26). 1879. **B**

Miles, Mrs. Cornelia, Principal of Broadway School, 1544 Franklin St., Denver, Colo. (50). **G**

Miles, Francis T., M.D., 514 Cathedral St., Baltimore, Md. (50). **K**

Milham, Willis I., Williams College, Williamstown, Mass. (47). **A B**

Millar, John M., Escanaba, Mich. (50).

Miller, Armand R., Professor of Chemistry, Manual Training High School, Kansas City, Mo. (50). **C**

*Miller, Prof. Arthur M., State College, Lexington, Ky. (45). 1898. **E**

Miller, Benjamin LeRoy, Johns Hopkins Univ., Baltimore, Md. (50). **E**

*Miller, Prof. Dayton C., Case School of Applied Science, Cleveland, Ohio. (44). 1898. **B**

MILLER, EDGAR G., 213 E. German St., Baltimore, Md. (29). **A E F**

*Miller, Edmund H., Ph.D., Columbia University, New York, N. Y. (50). 1901. **C**

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*Miller, Ephraim, Professor of Mathematics and Astronomy, State University, Lawrence, Kan. (50). 1901. **A**

Miller, Prof. Frank E., Westerville, Ohio. (44). **A**

*Miller, George A., Ph.D., Stanford University, Cal. (46). 1898. **A**

Miller, George N., M.D., 811 Madison Ave., New York, N. Y. (50). **K**

Miller, Henry Huntington, Mining and Metallurgical Engineer and Chemist, care American Copper Mining Co., Box 6, Somerville, N. J. (50). **C D E**

Miller, Herbert Stanley, Electrical Engineer, 1025 East Jersey St., Elizabeth, N. J. (50). **D**

Miller, John A., 2500 Park Ave., Cairo, Ill. (22). **D**

Miller, John Craig, M.D., Professor of Natural Science, Lincoln University, Pa. (50). **B C J**

Miller, Miss Louise Klein, School of Practical Agriculture, Briarcliff Manor, N. Y. (50). **I**

Miller, P. Schuyler, Mt. Prospect Laboratory, Flatbush Ave., Brooklyn, N. Y. (46). **C**

Miller, Pleasant T., 816 No. 9th St., Temple, Texas. (50).

*Miller, Prof. William S., University of Wisconsin, Madison, Wis. (42). 1894. **F**

Millis, John, Major of Engineers U. S. A., Seattle, Wash. (48). **A B D E**

*Mills, Prof. James, Ontario Agricultural College, Guelph, Ontario, Can. (31). 1895. **C I**

Mills, Samuel C., Newburgh, N. Y. (50). **I**

*Mills, Prof. Wesley, McGill University, Montreal, Can. (31). 1886. **F H**

Mills, William C., Orton Hall, Ohio State University, Columbus, Ohio. (48).

Minns, Miss S., 14 Louisburg Square, Boston, Mass. (32).

*Minot, Charles Sedgwick, M.D., Harvard Medical School, Boston, Mass. (28). 1880. **F**

Mitchell, Edward, 44 Wall St., New York, N. Y. (50).

Mitchell, Henry Bedinger, Tutor in Mathematics, Columbia University, New York, N. Y. (50). **A**

Mitchell, James, Newburgh, N. Y. (50). **A**

Mitchell, Roland G., 141 Water St., New York, N. Y. (50).

Mixer, Fred K., 427 Delaware Ave., Buffalo, N. Y. (35). **E**

Mohler, John F., 127 S. College St., Carlisle, Pa. (44). **B**

Mohr, Louis, M.E., 32 Illinois St., Chicago, Ill. (50). **A D**

*Moler, Geo. S., 106 University Ave., Ithaca, N. Y. (38). 1892.

Molitor, Frederic Albert, Little Rock, Ark. (51).

Monroe, Joseph E., Professor of Physics and Chemistry, Montana State Normal School, Dillon, Mont. (50). **B C**

*Monroe, Will S., State Normal School, Westfield, Mass. (49). 1901. **H**

Montfort, Wilson F., 524 4th St., Marietta, Ohio. (48). **C**

Montgomery, Edmund, M.D., Hemstead, Texas (50). **K**

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Montgomery, James H., Meadville, Pa. (50).
Moody, Lucius W., New Haven, Conn. (43). **H**
Moody, Mrs. Mary B., M.D., Fair Haven Heights, New Haven, Conn. (25). **E F**
*Moody, Robert O., M.D., Fair Haven Heights, New Haven, Conn. (35). 1892. **F**
Moody, William Albion, Professor of Mathematics, Bowdoin College, Brunswick, Maine. (50). **A**
Moore, Mrs. A. H., Sawyerville, P. Q., Canada (32). **H**
*Moore, Burton E., University of Nebraska, Lincoln, Nebr. (41). 1899. **B**
Moore, Charles James, E. M., P. O. Box 548, Cripple Creek, Colo. (50). **D E**
*Moore, Clarence B., 1321 Locust St., Philadelphia, Pa. (44). 1897. **H**
Moore, Ernest Carroll, Ph.D., Instructor in Philosophy, University of California, Berkeley, Cal. (50). **I**
Moore, Geo. D., Ph.D., 201 Salisbury St., Worcester. Mass. (40).
*Moore, George Thomas, U. S. Dept. Agriculture, Washington, D. C. (49). 1901. **G**
*Moore, J. W., M.D., Lafayette College, Easton, Pa. (22). 1874. **A B D**
Moore, Philip North, Geologist and Mining Engineer, 121 Leclede Bldg., St. Louis, Mo. (50). **E**
Moore, Robert, Civil Engineer, 61 Vandeventer Place, St. Louis, Mo. (51). **D**
Moore, Stanley H., Manual Training High School, Kansas City, Mo. (50). **A D**
*Moore, Willis L., Weather Bureau, U. S. Dep't Agriculture, Washington, D. C. (44). 1897. **B**
*Moorehead, Warren K., Curator of Museum, Phillips Academy, Andover, Mass. (38). 1890. **H**
Morgan, H. A., Professor of Zoology and Entomology, State University, Baton Rouge, La. (50). **F**
Morgan, Wm. F., Short Hills, N. J. (27).
*Morison, George Shattuck, C.E., 49 Wall St., New York, N. Y. (50). 1901. **D**
*Morley, Prof. Edward W., Adelbert College, Cleveland, Ohio. (18). 1876. **B C E**
Morrey, Charles B., Ohio State University, Columbus, Ohio. (48). **F**
Morris, Henry L., 16 Exchange Place, New York, N. Y. (49).
Morris, Newbold, 52 E. 72nd St., New York, N. Y. (49).
Morris, Russell Love, Professor of Civil and Mining Engineering, West Virginia State University, Morgantown, W. Va. (50). **D**
Morrison, Gilbert B., 2510 Perry Ave., Kansas City, Mo. (48). **B C I**
Morse, Albert P., Wellesley, Mass. (50). **F**
*Morse, E. S., Salem, Mass. (18). 1874. **F H**
Morse, Willard S., Apartado "A," Aguascalientes, Mexico. (50). **C D E**

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*Morton, H., Stevens Inst. Technology, Hoboken, N. J. (18). 1875. **B C**
Morton, James F., Andover, N. H. (50).
Moseley, Edwin L., High School, Sandusky, Ohio (34).
*Moser, Jefferson F., Commander U. S. N., Commanding U. S. S. "Albatross," Station D, San Francisco, Cal. (28). 1889. **E**
Moses, Prof. Alfred J., Columbia University, New York, N. Y. (49).
*Moses, Dr. Thomas F., Worcester Lane, Waltham, Mass. (25). 1883. **F H**
Mosman, Alonzo T., U. S. Coast and Geodetic Survey, Washington, D. C. (51). **D**
*Mottier, David M., Ph.D., Professor of Botany, University of Indiana, Bloomington, Ind. (50). 1901. **G K**
*Moulton, Forest Ray, Ph.D., Instructor in Celestial Mechanics, University of Chicago, Chicago, Ill. (50). 1901. **A**
Mowry, Wm. A., 17 Riverside Square, Hyde Park, Mass. (29). **I**
Moxom, Philip Stafford, D.D., Wingood Lodge, 83 Dartmouth Terrace, Springfield, Mass. (44). **H I**
Moyer, Lycurgus R., C.E., Montevideo, Minn. (50). **D G**
*Muir, John, Martinez, Cal. (22). 1900. **G**
Mulford, Miss A. Isabel, Missouri Botanical Garden, St. Louis, Mo. (45). **G**
*Mulliken, Samuel P., Mass. Inst. Technology, Boston, Mass. (43). 1899.
Munro, John Cummings, M.D., Instructor in Surgery, Harvard Medical School, Boston, Mass. (50). **F K**
*MUNROE, PROF. C. E., Columbian University, Washington, D. C. (22). 1874. **C**
Munson, T. V., Denison, Texas. (51). **G**
*Munson, Prof. Welton M., The University of Maine, Orono, Me. (41). 1899. **G F**
*Munsterberg, Hugo, Harvard University, Cambridge, Mass. (47). 1898.
*Murdoch, John, Public Library, Boston, Mass. (29). 1886. **F H**
Murdock, George J., Mechanician and Inventor, 248 Sixth Ave., Newark, N. J. (50). **A D**
Murray, Charles R., 185 Monroe St., Chicago, Ill. (47). **D**
*Murray, Daniel A., Ph.D., Dalhousie College, Halifax, N. S. (47). 1899. **A**
Murray, Robert Drake, M. D., Surgeon Marine Hospital Service, Key West, Fla. (50). **K**
Myer, Mrs. Mary H., 21 E. 60th St., New York, N. Y. (44).
Myers, Edward W., North Carolina Geological Survey, Chapel Hill, N.C. (49).
*Myers, Prof. G. W., 6026 Monroe Ave., Chicago, Ill. (46) 1899. **A**
*Myers, William S., M.Sc., F.C.S., Rutgers College, New Brunswick, N. J. (43). 1898. **C**
Myres, John L., M.A., F.S.A., Christ Church, Oxford, England. (46). **H**
*Nagle, Prof. James C., A. and M. College, College Station, Texas (40). 1893. **B D**

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Nash, Geo. V., Norwood Heights, Williamsbridge, New York, N. Y. (47).
*Nason, Frank L., West Haven, Conn. (36). 1888. E
*Needham, James G., Lake Forest College, Lake Forest, Ill. (45). 1898. F
*Nef, J. U., University of Chicago, Chicago, Ill. (39). 1891. C
Negley, Henry Hillis, 600 N. Negley Ave., Pittsburg, Pa. (50). G
Neiler, Samuel Graham, Consulting and Designing Engineer, 1409 Manhattan Bldg., Chicago, Ill. (50). D
Neilson, John, Larchmont, N. Y. (50).
Nelson, Aven, Professor of Biology, University of Wyoming, Laramie, Wyoming. (50). F
*Nelson, Prof. A. B., Centre College, Danville, Ky. (30). 1882. A B D
Nelson, Wm., Rooms 7 and 8, Paterson Nat'l Bank, Paterson, N. J. (42).
Nelson, Wolfred, C.M., M.D., F.R.G.S., Astor House, New York, N. Y. (35). E H
Nesmith, Henry E., Jr., 28 South St., New York, N. Y. (30). B C F
Nesmith, John W., 1100 Colfax Ave., E., Denver, Colo. (50). B C
Ness, Helge, Professor of Botany, Agric. & Mech. College, College Station, Texas. (50). G
*Newcomb, Harry T., 137 S. 5th St., Philadelphia, Pa. (47). 1898. I
*Newcomb, Prof. S., 1620 P St., N. W., Washington, D. C. (13). 1874. A B
*Newcombe, Frederick Charles, 1021 E. University Ave., Ann Arbor, Mich. (43). 1896. G
*Newell, F. H., U. S. Geol. Survey, Washington, D. C. (40). 1893. E
*Newell, William Wells, Editor Journal American Folk Lore, Cambridge, Mass. (41). 1893. H
Newsom, John F., Stanford University, Cal. (44). E
*Newson, Henry Byran, Assistant Professor of Mathematics, University of Kansas, Lawrence, Kansas. (50). 1901. A
Nichols, Austin P., 4 Highland Ave., Haverhill, Mass. (37).
*Nichols, Ernest Fox, Dartmouth College, Hanover, N. H. (41). 1893. B
*Nichols, E. L., Ph.D., Cornell University, Ithaca, N. Y. (28). 1881. B C
Nichols, Othniel Foster, C.E., Principal Assistant Engineer, New East River Bridge, 42 Gates Ave., Brooklyn, N. Y. (51). D
Nicola, Frank F., Cor. Wood and Sixth Aves., Pittsburg, Pa. (50). D
Niles, Robert Lossing, 66 Broadway, New York, N. Y. (47). B C D
*Niles, Wm. H., Mass. Inst. Tech., Boston, Mass. (16). 1874. E
*Nipher, Prof. Francis E., Washington University, St. Louis, Mo. (24). 1876. B
*Nolan, Edw. J., M.D., Acad. Nat. Sciences, Philadelphia, Pa. (29). 1890. F
*Norton, J. B. S., College Park, Md. (47). 1899. G
*NORTON, THOMAS H., U. S. Consul, Harput, Turkey in Asia (35). 1887. C

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Notestein, F. N., Professor of Mathematics and Physics, Alma College, Alma, Mich. (50). **A B**

Nott, Charles Palmer, Palo Alto, Cal. (50).

*Novy, Dr. Frederick G., Univ. of Michigan, Ann Arbor, Mich. (36). 1889. **C**

*Noyes, Prof. Arthur A., Mass. Inst. Technology, Boston, Mass. (45). 1897. **C**

Noyes, Isaac Pitman, 409 4th St., S. E., Washington, D. C. (49).

*Noyes, Miss Mary Chilton, Ph.D., Lake Erie College, Painesville, Ohio. (43). 1896. **B**

Noyes, Theodore Richards, M.D., Kenwood, N. Y. (51).

*Noyes, Prof. Wm. A., Rose Polytechnic Institute, Terre Haute, Ind. (23). 1885. **C**

Nunn, R. J., M.D., 119 York St., Savannah, Ga. (33). **B H**

*Nuttall, Mrs. Zelia, Peabody Museum, Cambridge, Mass. (35). 1887. **H**

*Nutting, Prof. Charles C., State University of Iowa, Iowa City, Iowa. (40). 1892. **F**

Nylander, Olof O., Box 165, Caribou, Maine. (50). **F**

Oakes, F. James, 58 Stone St., New York, N. Y. (49).

*Oberholser, Harry Church, Div. Biological Survey, U. S. Dep't Agriculture, Washington, D. C. (46). 1898. **E F H**

Obrig, Adolph, 'The Dakota,' 1 W. 72d St., New York, N. Y. (50).

O'Connor, Joseph, 146 Frank St., Rochester, N. Y. (41).

Oestlund, Oscar W., Entomologist, State University, Minneapolis, Minn. (50). **F**

Offinger, Martin H., M.E., Director Electro-Mech. Dep't, Buffalo Commercial and Electro-Mech. Institute, Buffalo, N. Y. (50). **D**

*Ogden, Herbert G., U. S. C. and G. Survey, Washington, D. C. (38). 1891. **E**

Ogden, Herbert Gouverneur, Jr., M.E., 1610 Rigg Place, Washington, D. C. (50). **B D**

Ogilvie, Miss Ida Helen, Sherman Square Hotel, New York, N. Y. (51). **E**

Oglevee, Christopher S., Instructor in Biology, Lincoln University, Lincoln, Ill. (50). **F**

O'Harra, Prof. Cleophas C., State School of Mines, Rapid City, So. Dak. (49).

Olcott, George M., 86 William St., New York, N. Y. (49).

Olive, Edgar W., University Museum, Cambridge, Mass. (48). **G**

Olmsted, John Charles, Landscape Architect, 16 Warren St., Brookline, Mass. (50). **E I**

Oothout, William, Chemist, Metallurgist and Mining Engineer, Santa Barbara, Cal. (50). **C D E**

Opdyke, William S., 20 Nassau St., New York, N. Y. (49).

*Orleman, Miss Daisy M., M.D., Peekskill Military Academy, Peekskill, N. Y. (40). 1897. **F**

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*Orleman, Col. Louis H., Ph.D., Principal Peekskill Military Academy, Peekskill, N. Y. (47). 1900.
*Orr, William, Jr., 30 Firglade Ave., Springfield, Mass. (39). 1895. **B F**
*Orton, Edward, Jr., The Normandie, Columbus, Ohio. (48). 1900. **E**
Orton, Orville D., 185 Monroe St., Chicago, Ill. (48). **H I**
*Orton, W. A., Div. of Veg. Phys. and Path., U. S. Dept. Agriculture, Washington, D. C. (49). **G**
Osborn, Frederick A., Prof. of Physics, Olivet Coll., Olivet, Mich. (50). **B**
*Osborn, Henry F., Columbia University, New York, N. Y. (29). 1883. **F**
*Osborn, Herbert, Ohio State University, Columbus, Ohio. (32). 1884. **F**
Osborn, Mrs. W. H., 32 Park Ave., New York, N. Y. (50).
Osborne, Frank Russell, Professor of Physics, John B. Stetson University, DeLand, Fla. (50). **B**
Osborne, George Abbott, Professor of Mathematics, Mass. Inst. of Technology, Boston, Mass. (50). **A**
Osborne, Loyall Allen, E.E., Mgr. of Works of Westinghouse Electric and M'f'g. Co., Pittsburg, Pa. (50). **D**
Osburn, Raymond Carroll, Professor of Zoology, Fargo College, Fargo, North Dakota. (50). **F**
Osgood, Joseph B. F., Salem, Mass. (31).
*Osmond, Prof. I. Thornton, State College, Pa. (33). 1889. **A B C**
O'Sullivan, Rev. Denis T., S.J., 761 Harrison St., Boston, Mass. (40). **A B**
Owen, Charles Lorin, Field Columbian Museum, Chicago, Ill. (50). **H**
Owen, Prof. D. A., Franklin, Ind. (34). **E**
Owen, Miss Juliette A., 306 N. Ninth St., St. Joseph, Mo. (50). **F**
Owen, Miss Luella Agnes, 306 N. Ninth St., St Joseph, Mo. (47). **E**
Owen, Miss Mary Alicia, 306 N. Ninth St., St. Joseph, Mo. (50). **H**
Owens, William Gundy, Professor of Chemistry and Physics, Bucknell University, Lewisburg, Pa. (50). **B C**
*Packard, Dr. A. S., 115 Angell St., Providence, R. I. (16). 1875. **E F**
Packard, George Arthur, Metallurgist and Mining Engineer, 18 Lafayette St., Wakefield, Mass. (50). **E**
Packard, John C., 14 Searle Ave., Brookline, Mass. (48). **B**
*Paddock, Wendell, Professor of Botany and Horticulture, Agricultural College, Fort Collins, Colo. (50). 1901. **G**
PAGE, CLARENCE V., Civil and Mining Engineer, P. O. Box 922, Butte, Montana. (51). **D**
PAGE, DR. DUDLEY L., 46 Merrimack St., Lowell, Mass. (33). **F**
PAGE, MRS. NELLIE K., 46 Merrimack St., Lowell, Mass. (33). **F**
*Paine, Cyrus F., 242 East Ave., Rochester, N. Y. (12). 1874. **A B**
Paine, Robert Treat, President, Associated Charities of Boston, 6 Joy St., Boston, Mass. (50). **I**
Painter, Charles Fairbank, M.D., 372 Mulboro St., Boston, Mass. (50). **F K**
*Palache, Charles, University Museum, Cambridge, Mass. (44). 1896. **E**

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*Palmer, Prof. Albert De Forest, Brown University, Providence, R. I. (47). 1900. B

*Palmer, Prof. Arthur William, 804 W. Green St., Urbana, Ill. (46). 1898. C

*Palmer, Charles Skeele, Ph.D., Professor of Chemistry, University of Colorado, Boulder, Colo. (50). 1901. C

Palmer, Dr. Edward, Botanical Div., U. S. Dep't Agriculture, Washington, D. C. (22). H

Palmer, Walter Keifer, 411 New York Life Bldg., Kansas City, Mo. (47). B D

*Pammel, Prof. L. H., Iowa Agricultural College, Ames, Ia. (39). 1892. G

PARISH, HENRY, 52 Wall St., New York, N. Y. (49).

*Park, Roswell, M. D., 510 Delaware Ave., Buffalo, N. Y. (45). 1901. H K

Parker, Miss Florence, 10340 Longwood Ave., Chicago, Ill. (50). E

*Parker, George Howard, Assistant Professor of Zoology, Harvard University, Cambridge, Mass. (50). 1901. F

*Parker, Herschel C., 21 Fort Greene Place, Brooklyn, N. Y. (43). 1900. C

Parker, J. B., M.D., U. S. N., U. S. Naval Home, Philadelphia, Pa. (50). K

Parker, Moses Greeley, M.D., 11 First St., Lowell, Mass. (47). H

Parker, Richard Alexander, C. E., E. M., 4 P. O. Square, Boston, Mass. (50). D E

Parker, William L., 339 Marlborough St., Boston, Mass. (50).

*PARKHURST, HENRY M., 173 Gates Ave., Brooklyn, N. Y. (23). 1874. A

*Parks, C. Wellman, Civil Engineer, U. S. N., Bureau of Navigation, Washington, D. C. (42). 1897.

Parmelee, H. P., 594 Cherry St., Grand Rapids, Mich. (42). E H

Parmly, C. Howard, C. E,, Asst. Prof. of Physics, College of the City of New York, N. Y. (50). B

Parsell, Henry V. A., Jr., 31 E. 21st St., New York, N. Y. (49).

*Parsons, Prof. C. Lathrop, Durham, N. H. (41). 1896.

Parsons, Mrs. Edwin, 326 W. 90th St., New York, N. Y. (50).

PARSONS, JOHN E., 111 Broadway, New York, N. Y. (36).

Paton, Stewart, M.D., 213 W. Monument St., Baltimore, Md. (50). K

Patrick, Frank, 601 Kansas Ave., Topeka, Kansas. (50).

Patten, Miss Juliet, 3033 P St., N. W., Washington, D. C. (49). C F G

Patterson, Charles H., Professor of English Language and Literature, University of West Virginia, Morgantown, W. Va. (51). H

Patterson, Mrs. Flora Wambaugh, U. S. Dep't Agriculture, Washington, D. C. (44). G

*Patterson, George W., Jr., 814 S. University Ave., Ann Arbor, Mich. (44). 1896.

*Patterson, Harry J., College Park, Md. (36). 1890. C

Patterson, Prof. James L., Chestnut Hill, Philadelphia, Pa. (45).

Pattison, Frank A., Consulting Electrical Engineer, 141 Broadway, New York, N. Y. (50). D

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Patton, Arthur L., State Preparatory School, Boulder, Colo. (50). B C

*Patton, Horace B., Golden, Colo. (37). 1901. E

Patton, John, Counsellor-at-Law, 925 Mich. Trust Co. Bldg., Grand Rapids, Mich. (50). I

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*Porter, W. Townsend, M.D., Assistant Professor of Physiology, Harvard Medical School, Boston, Mass. (50). 1901. K
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*Pulsifer, Wm. H., Nonquitt, Mass. (26). 1879. **A H**

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Putnam, Mrs. Mary L. D., President of the Davenport Academy of Science, Davenport, Iowa. (50). **H**

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*Ramaley, Francis, University of Colorado, Boulder, Colo. (45). 1899. **G**

Ramsey, Rolla Roy, Instructor in Physics, Indiana University, Bloomington, Ind. (50). **B**

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*Rand, Theodore D., Radnor, Pa. (47). 1901. **E**

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Randolph, Prof. L. S., Blacksburg, Va. (33). **D**

*Rane, Frank Wm., New Hampshire Agric. Exper. Station, Durham, N. H. (42). 1900. **G**

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*Raymond, William G., Rensselaer Polytechnic Institute, Troy, N. Y. (44). 1896. **D**

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*Reese, Charles L., N. J. Zinc Co., Palmerton, Pa. (39). 1892. **C**

Reese, Herbert M., Mt. Hamilton, Cal. (49). **B**

*Reese, Jacob, 400 Chestnut St., Philadelphia, Pa. (33). 1891. **B D**

*Reid, Harry Fielding, Johns Hopkins University, Baltimore, Md. (36). 1893. **B**

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*Richards, Prof. Robert H., Mass. Institute of Technology, Boston, Mass. (22). 1875. **D**

*Richards, Mrs. Robert H., Mass. Institute of Technology, Boston, Mass. (23). 1878. **C**

*Richards, Prof. Theodore William, Harvard University, Cambridge, Mass. (47). 1899.

Richardson, Alonzo Blair, M.D., Supt. of Government Hospital for Insane, Washington, D. C. (50). **K**

Richardson, Major Charles A., Canandaigua, N. Y. (50). **I**

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Sage, John H., Portland, Conn. (23). F

Sager, Fred. Anson, Asst. Professor of Physics, University of Illinois, Urbana, Ill. (50). B

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*Sayre, Robert H., South Bethlehem, Pa. (28). 1899. D

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Schiaffino, Mariano L., Chief Electrical Engineer, "Campania de Luz de Guadalajara," Belen 2, Apartado 260, Guadalajara, Mexico. (50). **D**

Schiedt, Richard Conrad, Professor of Biology, Franklin and Marshall College, Lancaster, Pa. (50). **F**

Schieffelin, Eugene, 865 Madison Ave., New York, N. Y. (50).

Schieren, Hon. Charles A., 405 Clinton Ave., Brooklyn, N. Y. (43). **C I**

Schiertz, Ferdinand Alfred, Rosario Mines, Ltd., Guadalupe y Calvo, Estado de Chihuahua, Mexico. (50). **D E**

Schiff, Jacob H., P. O. Box 1193, New York, N. Y. (49).

Schirmer, Gustave, 117 E. 35th St., New York, N. Y. (49).

Schlichting, Emil, Analytical Chemist, 646 Broadway, Milwaukee, Wis. (50). **C**

*Schlotterbeck, Julius O., Ann Arbor, Mich. (46). 1899. **G**

Schmeckebier, Lawrence Frederick, Ph.D., U. S. Geol. Survey, Washington, D. C. (50). **E I**

Schmid, Dr. H. Ernest, White Plains, N. Y. (25).

Schmitt, A. Emil, M.D., 310 East 57th St., New York, N. Y. (50). **K**

Schmitt, Ewald, 2235 13th St., N. W., Washington, D. C. (51).

Schobinger, John J., 2101 Indiana Ave., Chicago, Ill. (34). **B**

*Schöney, L., M.D., 23 W. 135th St., New York, N. Y. (29). 1900. **F**

Schuette, J. H., Green Bay, Wis. (34). **B E F**

Schultz, Carl H., 430–444 First Ave., bet. 25th and 26th Sts., New York, N. Y. (29).

*Schurman, Jacob Gould, LL.D., President Cornell University, Ithaca, N. Y. (49). 1901.

Schuyler, Philip, Irvington-on-Hudson, N. Y. (49).

Schwarz, E. A., U. S. Department of Agriculture, Washington, D. C. (29). 1895. **F**.

*Schweitzer, Prof. Paul, State Univ. of Missouri, Columbia, Mo. (24). 1877. **B C**

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Scott, Arthur Curtis, Kingston, R. I. (47).
Scott, Prof. Arthur William, St. David's College, Lampeter, S. Wales, England. (46). **A B**
*Scott, Charles F., Westinghouse Electric and Mfg. Co., Pittsburg, Pa. (48). 1900. **B**
Scott, Martin P., M.D., Maryland Agric. College, College Park, Md. (31).
Scott, William, Counsel for Penna. R. R. Co., 450 4th Ave., Pittsburg, Pa. (50). **I**
Scott, W. M., State Entomologist, Atlanta, Ga. (50). **F**
Scripture, Arthur M., Principal of High School, New Hartford, N. Y. (51). **D**
*Scripture, E. W., Yale University, New Haven, Conn. (46). 1901. **H**
*Scudder, Samuel H., Cambridge, Mass. (13). 1874. **F**
*Scull, Miss Sarah A., Smethport, Pa. (40). 1895. **H**
Seal, Alfred Newlin, Ph.D., Professor of Chemistry, Girard College, Philadelphia, Pa. (50). **B C**
*Seaman, W. H., Chemist, 1424 11th St., N. W., Washington, D. C. (23). 1874. **C F**
Searing, Anna H., M.D., Escondido, Cal. (41). **G**
*Searle, Prof. George M., St. Thomas College, Catholic University, Washington, D. C. (39). 1891. **A**
Sears, Edward H., Collinsville, Conn. (50). **D I**
Sears, Frederick Edmund, St. Paul's School, Concord, N. H. (47). **C E**
Sears, Henry Francis, 8 Beacon St., Boston, Mass. (50).
Seashore, Carl E., Univ. of Iowa, Iowa City, Iowa. (49). **H**
Seawell, Benjamin Lee, Teacher of Biology, State Normal School, Warrensburg, Mo. (50). **F**
Sebert, William F., 48 Strong Place, Brooklyn, N. Y. (41). **A E**
*Sedgwick, William Thompson, Massachusetts Institute of Technology, Boston, Mass. (47). 1898. **F G**
*See, Horace, 1 Broadway, New York, N. Y. (34). 1886. **D**
*See, Prof. T. J. J., U. S. Naval Observatory, Washington, D. C. (48). 1901. **A**
*Selby, Augustine Dawson, Agric'l Exper. Station, Wooster, Ohio. (44). 1900. **G**
Seligman, Isaac N., Mills Building, New York, N. Y. (49).
Sercombe, Parker H., Banker, 1a Calle San Francisco, No. 8, City of Mexico, Mexico. (51). **H**
Serrell, Gen. Edward Wellman, C.E., Forest Ave., West New Brighton, N. Y. (50). **B C D**
Sessinghaus, Gustavus, E.M., Alma, Colo. (50). **E**
Sever, George F., Columbia University, New York, N. Y. (49). **B**
Seymour, A. T., 512 S. 1st Ave., Mt. Vernon, N. Y. (47).
*Seymour, Paul Henry, 215 East 61st St., Chicago, Ill. (44). 1896. **C**
Shaffner, Samuel C., Supt. Electric Lighting Co., Mobile, Ala. (50). **C D**

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Shantz, Homer LeRoy, Colorado Springs, Colo. (50). **F**
Sharp, Charles Cutler, C.E., E.M., President Raven Coal and Coke Co., Boomer, W. Va. (50). **D E**
*Sharp, Dr. Clayton H., Box 114, Newark, N. J. (45). 1897.
Sharpe, Benjamin F., Greenwich, N. Y. (50). **B**
Sharpe, Richard W., 732 Emerson St., Evanston, Ill. (51). **F**
Sharples, Philip Price, A.B., 22 Concord Ave., Cambridge, Mass. (47). **C**
*Sharples, Stephen P., 13 Broad St., Boston, Mass. (29). 1884. **C**
*Shattuck, Frederick C., M.D., Professor Clinical Medicine, Harvard Medical College, Boston, Mass. (50). 1901. **F K**
*Shattuck, George Burbank, Johns Hopkins University, Baltimore, Md. (47). 1899. **E**
Shattuck, Samuel Walker, Professor of Mathematics, University of Illinois, Champaign, Ill. (50). **A**
Shaw, Edwin C., 104 Park St., Akron, Ohio. (50). **D**
Shaw, Wilson A., Cashier Merchants and Manuf. National Bank, Norwood Ave., cor. Forbes Ave., Pittsburg, Pa. (50). **I**
SHEAFER, A. W., Pottsville, Pa. (28).
*Shear, Cornelius L., U. S. Dep't Agriculture, Washington, D. C. (49) 1901. **G**
Shedd, John C., Colorado Springs, Colo. (50). **A B**
Shedd, Solon, Professor of Geology and Mining, Agricultural College, Pullman, Wash. (50). **E**
Sheffield, George St. John, Twin Elms Farm, Attleborough, Mass. (50).
Sheldon, John Lewis, University of Nebraska, Lincoln, Nebraska. (50). **G**
Sheldon, Mrs. J. M. Arms, 18 W. Cedar St., Boston, Mass. (44). **F**
*Sheldon, Samuel, A.M., Ph.D., Polytechnic Institute, Brooklyn, N. Y. (42). 1894. **B**
*Shelton, Edward M., 2728 Boylston Ave., Seattle, Wash. (32). 1892. **F**
SHEPHERD, MISS ELIZABETH, 253 W. 128th St., New York, N. Y. (39).
Shepherd, Frank I., University P. O., Los Angeles, Cal. (48). **C**
Sherman, Franklin, Jr., State Entomologist, Raleigh, N. C. (50). **F**
Sherman, Lewis, M.D., 448 Jackson St., Milwaukee, Wis. (50). **K**
Shiland, Andrew, Jr., 262 W. 78th St., New York, N. Y. (50).
*Shimer, Porter W., E.M., Ph.D., Easton, Pa. (38). 1889. **C**
Shinn, Charles Howard, Inspector of Experiment Stations, University of California, Berkeley, Cal. (50). **F G**
Shrader, John Clinton, M.D., LL.D., President Iowa State Board of Health, Iowa City, Iowa. (50). **F K**
Shropshire, Walter, M.D., Yoakum, Texas. (50). **F K**
Shultz, Charles S., Hoboken, N. J. (31). **F**
Shute, D. K., M.D., 1101 13th St., N. W., Washington, D. C. (50). **F I K**
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*Sigsbee, Charles D., Captain U. S. N., Navy Department, Washington, D. C. (28). 1882. D E

Silloway, Perley Milton, Principal of High School, Lewistown, Montana. (51). F

Silvester, Richard W., President Maryland Agricultural College, College Park, Md. (50). G

*Simon, Dr. Wm., 1348 Block St., Baltimore, Md. (29). 1895. C

*Simonds, Prof. Frederic W., University of Texas, Austin, Texas. (25). 1888. E F

Simpson, Friench, Jr., Columbus, Texas. (50). F K

Singer, George Park, 545 W. Church St., Lock Haven, Pa. (50). B

Sirrine, F. Atwood, 110 New York Ave., Jamaica, N. Y. (44).

Skeel, Frank D., M.D., 58 East 25th St., New York, N. Y. (50). K

Skiff, F. J. V., Director, Field Columbian Museum, Chicago, Ill. (43).

*Skinner, Aaron Nichols, U. S. Naval Observatory, Washington, D. C. (40). 1893. A

Skinner, Clarence A., Ph.D., University of Nebraska, Lincoln, Nebr. (48). B

Skinner, Henry, M.D., 716 N. 20th St., Philadelphia, Pa. (47). F K

Slade, Elisha, Somerset, Mass. (29). F

Slagle, Robert Lincoln, Ph.D., President, State School of Mines, Rapid City, S. D. (50). C E

Sleffel, C. C., Columbia University, New York, N. Y. (48). D

*Slingerland, Mark Vernon, Assistant Professor of Economic Entomology, Cornell University, Ithaca, N. Y. (50). 1901. F

Slocum, Chas. E., M.D., Defiance, Ohio. (34). F G H

Slocum, Frederick, Ph.D., Ladd Observatory, Providence, R. I. (47).

Slonaker, James Rollin, University of Chicago, Chicago, Ill. (49). F

*Slosson, Edwin E., Professor of Chemistry, University of Wyoming, Laramie, Wyoming. (50). 1901. C

Small, John Kunkel, N. Y. Botanical Garden, Bronx Park, New York, N. Y. (44). G

Smallwood, Martin, Professor of Biology and Geology, Allegheny College, Meadville, Pa. (50). E F

Smillie, Thomas W., U. S. National Museum, Washington, D. C. (40). F

*Smith, Alexander, Ph.D., University of Chicago, Chicago, Ill. (40). 1892. C

Smith, Allen J., M.D., School of Medicine, University of Texas, Galveston, Tex. (47). H

Smith, Mrs. Annie Morrill, 78 Orange St., Brooklyn, N. Y. (49). G

Smith, Arthur, 152 Broadway, New York, N. Y. (50). G

Smith, Arthur George, Assistant Professor of Mathematics, State University, Iowa City, Iowa. (50). A

*Smith, Prof. A. W., Case School of Applied Science, Cleveland, Ohio. (47) 1900. C

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Smith, Arthur Whitmore, University of Mississippi, University, Miss. (44). **B**

*Smith, Charles J., 35 Adelbert St., Cleveland, Ohio. (32). 1885. **A B**

*Smith, Prof. Edgar F., University of Pennsylvania, Philadelphia, Pa. (33). 1891. **C**

*Smith, Erastus G., Ph.D., Director Beloit Sanitary Laboratory, Beloit, Wis. (34) 1887. **C**

*Smith, Ernest Ellsworth, 26 East 29th St., New York, N. Y. (43). 1898.

*Smith, Erwin F., U. S. Dep't Agriculture, Washington, D. C. (34). 1890. **G**

Smith, Eugene, C.E., 317 Washington St., Hoboken, N. J. (50). **D**

*Smith, Prof. Eugene Allen, University, Ala. (20). 1877. **C E**

*Smith, Frank, University of Illinois, Urbana, Ill. (49). 1900. **F**

*Smith, Harlan I., Amer. Mus. Nat. History, Central Park, New York, N. Y. (41). 1896. **H**

*Smith, Prof. Harold B., Polytechnic Institute, Worcester, Mass. (43). 1898. **D**

Smith, Harvey F., Attorney-at-Law, Clarksburg, W. Va. (50). **I**

Smith, Henry Louis, President Davidson College, Davidson, N. C. (50). **A B**

Smith, Herbert S. S., Professor of Applied Mechanics, Princeton University, Princeton, N. J. (29). **D**

Smith, Miss J. Angelina, Hopedale, Mass. (45). **E**

Smith, Rev. J. Barry, S. J., Professor of Chemistry, Georgetown University, Washington, D. C. (50). **C**

Smith, J. C., 131 Carondelet St., New Orleans, La. (48).

Smith, James Hervey, 217 North Central Ave., Chicago, Ill. (40).

*Smith, Jared G., Hawaiian Experiment Station, Honolulu, T. H. (47). 1901. **G**

*Smith, James Perrin, Ph.D., Ass't Prof. of Paleontology, Stanford University, Cal. (37). 1894. **C E**

SMITH, MISS JENNIE M., 803 Arch St., Allegheny, Pa. (50). **A F**

*Smith, John B., Ph.D., Rutgers College, New Brunswick, N. J. (32). 1884. **F**

Smith, Joseph R., M.D., LL.D., Colonel and Assistant Surgeon General, U. S. A., 2300 De Lancey St., Philadelphia, Pa. (43).

SMITH, MISS MATILDA H., 803 Arch St., Allegheny, Pa. (50). **A**

Smith, Matthew Mann, M.D., Austin, Texas. (50). **F K**

Smith, Philip Sidney, care Mich. Geol. Survey, Houghton, Mich. (47). **E**

*SMITH, Q. CINCINNATUS, M.D., 617 Colorado St., Austin, Texas. (26). 1881. **F**

Smith, Miss Sarah Winthrop, Nantucket, Mass. (50). **G H I**

Smith, Thomas A., Professor of Mathematics and Physics, Beloit College, Beloit, Wis. (50). **A B**

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Smith, T. Guilford, Civil Engineer, Regent, University State of New York, Buffalo, N. Y. (50). **D**

SMITH, USELMA C., 1515 Green St., Philadelphia, Pa. (33). **F**

*Smith, William Benjamin, Professor of Mathematics, Tulane University, New Orleans, La. (50). 1901. **A**

Smith, Wm. Lincoln, Consulting Electrical and Illuminating Engineer, 360 Marlborough St., Boston, Mass. (47). **D**

Smith, William Sidney Tangier, Ph.D., U. S. Geological Survey, Washington, D. C. (50). **E**

*Smock, Prof. John Conover, State Geologist, Trenton, N. J. (23). 1879. **E**

Smyth, Bernard Bryan, Librarian and Secretary of the Academy of Science, Topeka, Kansas. (51). **G**

*Smyth, C. H., Jr., Clinton, N. Y. (38). 1894. **E**

Snedaker, James A., Mining Engineer, 721–722 Equitable Bldg., Denver, Colo. (50). **D**

Snelling, Charles Mercer, Junior Professor of Mathematics, University of Georgia, Athens, Ga. (50). **A**

Snook, H. Clyde, Professor of Physics and Chemistry, Allegheny College, Meadville, Pa. (50). **B C**

*Snow, Benjamin W., 518 Wisconsin Ave., Madison, Wis. (35). 1889. **B**

*Snow, Prof. F. H., Chancellor University of Kansas, Lawrence, Kan. (29). 1881. **E F**

*Snyder, Prof. Harry, 2090 Dooley Ave., Saint Anthony Park, Minn. (44). 1897. **C**

Snyder, Miss Lillian, Lafayette, Ind. (47). **G**

*Snyder, Prof. Monroe B., Philadelphia Astronomical Observatory, Philadelphia, Pa. (24). 1882. **A B**

Snyder, Zachariah Xenophon, President State Normal School, Greeley, Colo. (50). **F**

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*Soule, R. H., 71 Broadway, New York, N. Y. (33). 1886. **D**

*Soule, William, Ph.D., Mount Union Coll., Alliance, Ohio (33). 1899. **B C E**

Souvielle, Mathieu, M.D., Box 355, Jacksonville, Fla. (36). **B E F**

Souvielle, Mrs. Mathieu, Box 355, Jacksonville, Fla. (24). **A B F**

*Spalding, Frederick P., Professor of Civil Engineering, Univ. of Missouri, Columbia, Mo. (46). 1899. **D**

Spaulding, Edward G., Ph.D., College of the City of New York, New York, N. Y. (50). **I**

Spencer, John Campbell, M.D., Medical Department, University of California, San Francisco, Cal. (50). **K**

*Spencer, Prof. J. William, 152 Bloor St., Toronto, Canada. (28). 1882. **E**

*SPENZER, JOHN G., M.D., 116 Rose Bldg., Cleveland, Ohio. (37). 1895. **C**

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*Speyers, Clarence Livingston, Professor of Physical Chemistry, Rutgers College, New Brunswick, N. J. (50). 1901. C

Spiegelhalter, Dr. Joseph, 2166 Lafayette Ave., St. Louis, Mo. (47). E

*Spinney, L. B., Iowa State College, Ames, Iowa. (42). 1897. B

Spofford, Paul N., P. O. Box 1667, New York, N. Y. (36).

Spohn, Arthur Edward, M.D., Corpus Christi, Texas. (50). K

Sprague, C. C., 1900 Locust St., St. Louis, Mo. (50).

SPRAGUE, C. H., Malden, Mass. (29).

*Springer, Dr. Alfred, 312 E. 2nd St., Cincinnati, Ohio. (24). 1880. C

Springsteen, Harry W., Case Sch. of App. Sci., Cleveland, Ohio. (49). A B

Squibb, Charles F., Bernardsville, N. J. (43).

Squibb, Edward Hamilton, M.D., P.O. Box 760, Brooklyn, N. Y. (41). F

Stackpole, Morrill D., Gen'l Supt. Overland Gold Mining Co., Sunshine, Utah. (50). E

Stahley, George D., M.D., Gettysburg, Pa. (47). F G

Stanley, William, Great Barrington, Mass. (50).

Stanton, John R., 11 and 13 William St., New York, N. Y. (49).

Stanton, Timothy W., Paleontologist, U. S. Geological Survey, Washington, D. C. (50). E

Starks, Edwin Chapin, Curator and Instructor, Department of Zoology, Stanford University, Cal. (50). F

*Starr, Frederick, Ph.D., University of Chicago, Chicago, Ill. (36). 1892. E H

*Starr, M. Allen, M.D., 5 West 54th St., New York, N. Y. (50). 1901. K

Starrett, M. G., 349 W. 85th St., New York, N. Y. (49).

*Stearns, Robert E. C., Ph.D., 1025 East Eighteenth St., Los Angeles, Cal. (18). 1874. F

Stearns, Thomas B., Mining Engineer, Denver, Colo. (50). D E

Stearns, T. C., M.D., 44 Montgomery St., Jersey City, N. J. (49).

Stebbins, Miss Fannie A., 480 Union St., Springfield, Mass. (44). F G

Steensland, Halbert Severin, M.D., College of Medicine, Syracuse University, Syracuse, N. Y. (50). K

Steer, Justin, M.D., Medical Department, Washington University, St. Louis, Mo. (50). K

*Steiger, George, Chemical Laboratory, U. S. Geol. Survey, Washington, D. C. (40). 1901. B C E

Stein, Dr. Simon G., Muscatine, Iowa. (43).

Steiner, Roland, Ph.D., Grovetown, Ga. (48). H

*Steinmetz, Charles Proteus, General Electric Co., Schenectady, N.Y. (40). 1895. B

Stephens, Henry Matthew, Professor of Biology, Dickinson College, Carlisle, Pa. (50). F G

*STEPHENS, W. HUDSON, Lowville, N. Y. (18). 1874. E H

Stern, Philip Kossuth, Consulting, Mechanical and Electrical Engineer, 130 Fulton St., New York, N. Y. (50). B D

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Sternberg, Charles Hazelius, Lawrence, Kansas. (50). E F

*Sternberg, George M., M.D., LL.D., Surgeon-General U. S. A., War Department, Washington, D. C. (24). 1880. F

Stetson, George R., 1441 Mass. Ave., N. W., Washington, D. C. (49). H I

Steuart, Arthur, 951 Equitable Building, Baltimore, Md. (48). C

Stevens, Edwin A., Mining Engineer, Victor, Colo. (50). D

*Stevens, Frank L., Ph.D., College of Agric. & Mech. Arts, West Raleigh, N. C. (44). 1899. G

Stevens, Frederick W., Department of Physics, Lake Forest University, Lake Forest, Ill. (50). B

Stevens, George T., M.D., 22 East 46th St., New York, N. Y. (28). B F

Stevens, James Franklin, M.D., 1136 O St., Lincoln, Neb. (50). F H K

*Stevens, James S., Orono, Me. (48). 1900. B

*Stevens, Prof. W. LeConte, Washington and Lee University, Lexington, Va. (29). 1882. B

*Stevenson, Mrs. Cornelius, 237 S. 21st St., Philadelphia, Pa. (33). 1895. H

Stevenson, Francis L., 79 Lincoln Ave., Chicago, Ill. (47). D

*Stevenson, Prof. John J., University Heights, New York, N. Y. (36). 1888. E

*Stevenson, Mrs. Matilda C., Bureau of American Ethnology, Washington, D. C. (41). 1893. H

Stevenson, Robert, Consulting Civil and Mining Engineer, P. O. Box 2214, San Francisco, Cal. (50). D E

Stewart, Douglas, Assistant to Director Carnegie Museum, Pittsburg, Pa. (50). E

*Stewart, Fred. Carlton, N. Y. Agric. Exper. Station, Geneva, N. Y. (44). 1901. G

Stewart, James Henry, Director of W. Va. Agric. Exper. Station, Morgantown, W. Va. (50). E

*Stewart, Oscar M., Assist. Professor of Physics, University of Missouri, Columbia, Mo. (46). 1900. B

Stewart, Robert W., M.D., Park Bldg., Pittsburg, Pa. (50). F K

Stickney, Gardner P., care Oliver C. Fuller & Co., Milwaukee, Wis. (44). 1901. H

*Stieglitz, Dr. Julius, University of Chicago, Chicago, Ill. (39). 1895. C

Stieringer, Luther, 129 Greenwich St., New York, N. Y. (50).

*Stiles, Charles W., Ph.D., Dept. of Agr., Washington, D.C. (40). 1892. F

Still, George A., 1428 Locust St., Des Moines, Iowa. (50). C

Stillhamer, Arthur G., Bloomington, Ill. (50). B

Stillman, Prof. John M., Stanford University, California. (41).

Stillwell, Lewis Buckley, Park Row Building, New York, N. Y. (50). B D

*Stine, Prof. W. M., Swarthmore College, Swarthmore, Pa. (37). 1900. A C

Stingley, Miss Lela Lorena, University of Denver, University Park, Colo. (50). A

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*Stockwell, John N., 1008 Case Ave., Cleveland, Ohio (18). 1875. **A**
Stokes, Anson Phelps, 47 Cedar St., New York, N. Y. (50). **I**
Stokes, Miss C. Phelps, 37 Madison Ave., New York, N. Y. (49).
*Stokes, Henry Newlin, Ph.D., U. S. Geol. Survey, Washington, D. C. (38). 1901. **C E**
Stokes, Miss O. E. P., 37 Madison Ave., New York, N. Y. (49).
Stone, Prof. George E., Mass. Agricultural College, Amherst, Mass. (48). **G**
Stone, Miss Isabelle, Ph.D., Instructor in Physics, Vassar College, Poughkeepsie, N. Y. (50). **B**
Stone, Julius F., Columbus, Ohio. (48).
Stone, Lincoln R., M.D., Newton, Mass. (31).
Stone, Mason A., 161 Broadway, New York, N. Y. (49).
*Stone, Ormond, Director Leander McCormick Observatory, University of Virginia, Charlottesville, Va. (24). 1876. **A**
Storer, Norman Wilson, care Westinghouse E. & M. Co., Pittsburg, Pa. (50). **D**
*Story, Prof. Wm. E., Clark University, Worcester, Mass. (29). 1881. **A**
*Stowell, Prof. T. B., Potsdam, N. Y. (28). 1885. **F**
*Stradling, Prof. George F., 4114 Parkside Ave., Philadelphia, Pa. (41). 1900. **B**
Strauss, Charles, 37 W. 75th St., New York, N. Y. (49).
Strong, Frederick F., M.D., 176 Huntington Ave., Boston, Mass. (47). **C F**
Strong, Frederick G., Box 959, Hartford, Conn. (50). **D**
*Strong, Wendell M., 32 Nassau St., New York, N. Y. (44). 1899. **A B**
*Stubbs, W. C., Ph.D., Director, State Experiment Station, Audubon Park, New Orleans, La. (40). 1901. **F**
Stump, James A., Instructor in Physics, Agricultural College, Fort Collins, Colo. (50). **B**
*Sturgis, Wm. C., 242 Prospect St., New Haven, Conn. (40). 1892. **G**
Sullivan, J. A., 30 Main St., Malden, Mass. (27). **A**
Summers, Henry E., Professor of Zoology, State College, Ames, Iowa. (50). **F**
Sumner, Francis B., Ph.D., Instructor in Natural History, College of the City of New York. (51). **F**
Surface, Harvey Adam, Professor of Zoology, Penna. State College, State College, Pa. (50). **F**
Sutton, Jasper G., M.D., Rushsylvania, Ohio. (48). **F K**
Sutton, William John, Geologist, Esquimalt and Nanaimo Ry. Co., Victoria, B. C. (50). **E**
Sutton, W. S., Professor of Science and Art of Education, University of Texas, Austin, Texas. (50). **I**
Swartzel, Karl D., Department of Mathematics, State University, Columbus, Ohio. (48). **A**

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Sweet, Henry N., 50 Beacon St., Boston, Mass. (40). **D H**

Swezey, Goodwin D., Professor of Astronomy and Meteorology, University of Nebraska, Lincoln, Neb. (50). **A**

*Swingle, Walter T., U. S. Dep't. Agriculture, Washington, D. C. (40). 1892. **G**

Swope, Gerard, Manager of the Western Electric Co., 810 Spruce Ss., St. Louis, Mo. (51). **B D**

TAFT, ELIHU B., Burlington, Vt. (36). **H**

Taggart, Rush, 319 West 75th St., New York, N. Y. (49).

*Tainter, Charles Sumner, care Am. Security and Trust Co., 1405 G St., N. W., Washington, D. C. (29). 1881. **A B D**

*Talbot, Henry P., Mass. Institute of Technology, Boston, Mass. (44). 1896. **C**

Talbott, Mrs. Laura Osborne, 1445 Huntington Place, Washington, D. C. (36). **F G I**

Tallman, William Duane, Professor of Mathematics, State College, Bozeman, Mont. (50). **A**

TALMAGE, JAMES EDWARD, Ph.D., Professor of Geology, University of Utah, Salt Lake City, Utah. (50). **E**

Tandberg, John P., Instructor in Physics and Chemistry, St. Olaf College, Northfield, Minn. (50). **B C**

*TANNER, PROF. JOHN HENRY, 7 Central St., Ithaca, N. Y. (47). 1899. **A B**

*Tarr, Ralph Stockman, Cornell University, Ithaca, N. Y. (49). 1901. **I**

Tatlock, John, Jr., 32 Nassau St., New York, N. Y. (50).

Taussig, James, Grand Avenue Hotel, St. Louis, Mo. (50). **I**

*Taylor, Alonzo Englebert, Professor of Pathology, University of California. Residence 2019 Broderick St., San Francisco, Cal. (50). 1901. **C K**

Taylor, Edward B., Pittsburg, Pa. (50). **D**

Taylor, Edward Randolph, Penn Yan, N. Y. (39). **C**

Taylor, Edward Wyllys, M.D., Harvard Medical School, Boston, Mass. (50). **K**

*Taylor, Frank B., 391 Fairfield Ave., Fort Wayne, Ind. (39). 1897.

Taylor, Henry L., 60 West 55th St., New York, N. Y. (49).

*Taylor, James M., Colgate University, Hamilton, N. Y. (33). 1901. **A D**

Taylor, Robert S., Box 2019, Fort Wayne, Ind. (39).

Tays, Eugene A. H., C. E., E. M., Manager Anglo-Mexican Mining Co., San José de Gracia, Sinaloa, Mexico. (50). **D E**

Teeters, Wilber John, State University, Iowa City, Iowa. (50). **C K**

*Tesla, Nikola, LL.D., 55 W. 27th St., New York, N. Y. (43). 1895. **B**

Thaw, Benjamin, President Hecla Coke Co., Morewood Place, Pittsburg, Pa. (50). **A D**

Thaw, Mrs. William, Box 1086, Pittsburg, Pa. (41). **H**

*Thaxter, Roland, Ph.D., Professor of Cryptogamic Botany, Harvard University, Cambridge, Mass. (50). 1901. **G**

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Thayer, Harry Stanley, Greeley, Colo. (50.) **C**

Thelberg, Elizabeth B., M.D., Resident Physician and Professor of Physiology and Hygiene, Vassar College, Poughkeepsie, N. Y. (50). **K**

Thiemann, Hermann, Manchester, Mass. (50). **G**

*Thom, Charles, Instructor in Botany, University of Missouri, Columbia, Mo. (50). 1901. **G**

*Thomas, Benjamin F., State University, Columbus, Ohio. (29). 1882. **A B**

Thomas, George T., M.D., Rogers, Texas. (50). **F K**

*Thomas, Prof. M. B., Crawfordsville, Ind. (41). 1894. **G**

Thompson, Alton H., D.D.S., 721 Kansas Ave., Topeka, Kan. (33). **H**

Thompson, Miss Anna F., P. O. Box 32, Summit, N. J. (49).

Thompson, James E., New Carlisle, Ohio. (48).

Thompson, James Edwin, 3224 Broadway, Galveston, Texas (50).

Thompson, J. L., M.D., 22 West Ohio St., Indianapolis, Ind. (39). **F**

*Thompson, Joseph Osgood, Amherst, Mass. (41). 1893.

Thompson, Robert M., 99 John St., New York, N. Y. (49).

Thompson, Rev. Walter, D.D., Garrison-on-Hudson, N. Y. (49).

Thompson, William, Mining, Metallurgical and Mechanical Engineer, Rossland Great Western Mines, Ltd., Rossland, B. C. (50). **D E**

Thompson, W. Gilman, M.D., 34 East 31st St., New York, N. Y. (50). **K**

*Thomson, Elihu, Swampscott, Mass. (37). 1888. **B**

*Thomson, Wm., M.D., 1426 Walnut St., Philadelphia, Pa. (33). 1885. **B**

Thornber, John J., Tucson, Arizona. (50). **G**

*Thornburg, Charles L., Lehigh Univ., S. Bethlehem, Pa. (44). 1897. **A**

*Thorndike, E. L., Ph.D., Teachers' College, New York, N. Y. (49). 1901. **H I**

THORNE, MRS. PHOEBE ANNA, 558 Madison Ave., New York, N. Y. (50).

Thorne, Samuel, Jr., 55 Liberty St., New York, N. Y. (49).

*Thruston, Gates Phillips, Nashville, Tenn. (38). 1890. **H**

*Thruston, R. C. Ballard, Ballard & Ballard Co., Louisville, Ky. (36). 1896. **E**

*Thurston, Prof. R. H., Sibley College, Cornell University, Ithaca, N. Y. (23). 1875. **D**

Tibbals, George Attwater, 148 Milton St., Brooklyn, N. Y. (51).

Tiffany, L. C., 27 East 72nd St., New York, N. Y. (50).

*Tight, Prof. William George, Albuquerque, N. M. (39). 1900. **E**

Tilley, Charles Edward, Teacher of Physics and Chemistry, Hope Street High School, Providence, R. I. (50). **B C**

Tilson, P. S., Associate Professor of Chemistry, A. and M. College, College Station, Texas (50). **C**

Tilton, John Littlefield, Simpson College, Indianola, Iowa. (50). **E**

Tingle, J. Bishop, Illinois College, Jacksonville, Ill. (50). **C**

Titchener, E. B., Professor of Psychology, Cornell University, Ithaca, N. Y. (51). **K**

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*Tittmann, Otto H., Supt. U. S. C. and G. Survey, Washington, D. C. (24). 1888. **A**

Titus, E., Jr., 10 East 70th St., New York, N. Y. (50).

Titus, E. S. G., Natural History Bldg., University of Illinois, Urbana, Ill. (50). **F**

Todd, Albert M., Kalamazoo, Mich. (37). **C**

*Todd, Prof. David P., Director Lawrence Observatory, Amherst College, Amherst, Mass. (27). 1881. **A D**

*Todd, Prof. James E., Vermilion, S. Dak. (22). 1886. **E F**

Todd, J. H., M.D., Christmas Knoll, Wooster, Ohio. (48).

Tolman, Rev. Marcus Aldan, 123 S. High St., Bethlehem, Pa. (50). **I**

Tonnele, Theodore, Metallurgical Engineer, 919 College Ave., Pittsburg, Pa. (50). **E**

Toothe, William, Madison, N. J. (49).

Totman, David M., M.D., 303 Montgomery St., Syracuse, N. Y. (50). **K**

Tower, Olin F., Ph.D., Instructor in Chemistry, Adelbert College, Cleveland, Ohio. (50). **C**

Towle, William Mason, State College, Pa. (44). **D**

Townsend, Charles O., U. S. Dept. Agriculture, Washington, D. C. (46).

Townson, Andrew J., President Board of Education, Granite Building, Rochester, N. Y. (50). **I**

*Tracy, Samuel M., Biloxi, Miss. (27). 1881. **G**

*Traphagen, Frank W., Ph.D., Bozeman, Montana. (35). 1889. **C E F**

Trask, Spencer, 27 Pine St., New York, N. Y. (50). **I**

Traylor, Miss Mary Clark, 653 S. Grant Ave., Denver, Colo. (50). **A**

Treat, Erastus B., 241–243 West 23rd St., New York, N. Y. (29). **F I**

*Trelease, Wm., Ph.D., Director Missouri Botanical Gardens, St. Louis, Mo. (39). 1891. **G**

Trimble, Robert E., Asst. Meteorologist and Irrigation Engineer, Agricultural College, Fort Collins, Colo. (50). **D E**

Troth, Alonzo P., Principal of High School, Leadville, Colo. (50). **F**

*Trowbridge, Augustus, Ph.D., Dept. Physics, University of Wisconsin, Madison, Wis. (47). 1900. **B**

*Trowbridge, Charles Christopher, Tutor in Physics, Columbia University, New York, N. Y. (50). 1901. **B**

Trowbridge, Rev. Charles R., 223 Porter St., Easton, Pa. (46). **H I**

Trowbridge, Luther H., 13 Madison Ave., Detroit, Mich. (29).

Trowbridge, Mrs. M. E. D., 13 Madison Ave., Detroit, Mich. (21). **G I**

*True, Fred W., U. S. National Museum, Washington, D. C. (28). 1882. **F**

*True, Rodney Howard, U. S. Dept. Agriculture, Washington, D. C. (46). 1899. **G**

Trueblood, Mary Esther, 9 Crawford St., Boston, Mass. (47). **A**

Truesdell, George, Room 22, Wyatt Building, Washington, D. C. (49). **I**

Tucker, Richard Hawley, C.E., Astronomer, Lick Observatory, Mt. Hamilton, Cal. (50.) **A D**

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Tucker, William Conquest, Civil and Sanitary Engineer, 156 Fifth Ave., New York, N. Y. (51). **D**

*Tucker, Willis G., M.D., Albany Medical College, Albany, N. Y. (29). 1888. **C**

*TUCKERMAN, ALFRED, Ph.D., 342 W. 57th St., New York, N. Y. (39). 1891. **C**

Tuckerman, Louis Bryant, Jr., Box 1096, Station A, Lincoln, Neb. (50). **A B**

*Tufts, Frank Leo, Ph.D.. Tutor in Physics, Columbia University, New York, N. Y. (50). 1901. **B**

Tuohy, John, Tulare, California. (50). **D I**

Turnbull, Thomas, Jr., M.D., Asst. Professor of Practice of Medicine, Allegheny University, Allegheny, Pa. (50). **K**

Turner, Archelaus E., President Waynesburg College, Waynesburg, Pa. (50). **E I**

Turner, J. Spencer, 109 Duane St., New York, N. Y. (43). **B**

*Tuttle, Prof. Albert H., University of Virginia, Charlottesville, Va. (17). 1874. **F**

Tweedy, Alice B., 712 West End Ave., New York, N. Y. (49).

*Twitchell, E., Wyoming, Ohio (39). 1891. **C**

Tyler, Ansel Augustus, Ph.D., Professor of Science, Bellevue College, Bellevue, Neb. (50).

Tyler, Dr. Harry Walter, 491 Boylston St., Boston, Mass. (47). **A**

Tyrrell, Joseph Burr, Mining Engineer, Dawson, Y. T., Canada. (50). **D E**

*Uhler, Philip R., 254 W. Hoffman St., Baltimore, Md. (19). 1874. **E F**

*Underwood, Lucien M., Columbia University, New York, N. Y. (23). 1885. **G**

*Upham, Warren, Sec'y Minnesota Historical Society, St. Paul, Minn. (25). 1880. **E**

*Upton, Winslow, Ladd Observatory, Providence, R. I. (29). 1883. **A**

Vail, Miss Anna Murray, 29 Washington Square, New York, N. Y. (50).

Vaile, Joel F., 420 Equitable Building, Denver, Colo. (50). **I**

Valentine, Edw. P., Richmond, Va. (33). **H**

*Van Amringe, John Howard, Professor of Mathematics, Columbia University, New York, N. Y. (50). 1901. **A**

Van Antwerp, Rev. Francis J., 26 Harper Ave., Detroit, Mich. (46).

VAN BEUREN, FREDERICK T., 21 W. 14th St., New York, N. Y. (36).

Van Brunt, Cornelius, 319 E. 57th St., New York, N. Y. (28).

Vanderpoel, Frank, M.D., 153 Center St., Orange, N. J. (50). **K**

Van Duyn, John, M.D., 318 James St., Syracuse, N. Y. (50). **F K**

*Van Dyck, Prof. Francis Cuyler, P. O. Box 224, New Brunswick, N. J. (28). 1882. **B C F**

Van Dyck, William Van Bergen, Instructor in Electricity, Rutgers College, New Brunswick, N. J. (50). **D**

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Van Gelder, Arthur P., Landing, N. J. (50).
Van Giesen, Ira, 1 Madison Ave., New York, N. Y. (49).
*Van Hise, Charles R., Univ. of Wisconsin, Madison, Wis. (37). 1890. E
Van Ingen, Dr. Gilbert, Columbia University, New York, N. Y. (49).
Van Orden, Charles H., Civil Engineer, Catskill, N. Y. (51). D
Van Ornum, Prof. John Lane, Professor of Civil Engineering, Washington University, St. Louis, Mo. (50). D
Vansize, William B., 253 Broadway, New York, N. Y. (50). D
Van Slooten, William, 35 Wall St., New York, N. Y. (49).
*Van Slyke, Lucius L., Agr. Exper. Station, Geneva, N. Y. (41). 1901. C
*Van Vleck, Prof. John M., Wesleyan University, Middletown, Conn. (23). 1875. A
Van Winkle, Edgar B., 115 E. 70th St., New York, N. Y. (49).
Varney, A. L., Major of Ordnance, U. S. A., San Antonio Arsenal, San Antonio, Texas (44). H
VAUX, GEORGE, JR., 404 Girard Building, Philadelphia, Pa. (33). A E
Veblen, Andrew A., Professor of Physics, State University, Iowa City, Iowa. (50). B
Veeder, Curtis Hussey, Mechanical Engineer, 40 Willard St., Hartford, Conn. (50). B D
Velsor, Joseph A., 105 McDonough St., Brooklyn, N. Y. (50). C
*Venable, Prof. F. P., Chapel Hill, N. C. (39). 1891. C
*Verrill, Prof. A. E., New Haven, Conn. (47). 1891. F
Villard, Mrs. Henry, 145 W. 58th St., New York, N. Y. (36).
Vinal, W. Irving, 1106 East Capitol St., Washington, D. C. (40). E
*Vining, E. P., 49 Second St., San Francisco, Cal. (32). 1887. H
*Vogdes, A. W., Captain 5th Artillery, U. S. A., San Cristobal, San Juan, Porto Rico. (32). 1885. E F
von Ihering, F., Musen Paulista, Sao Paulo, Brazil. (51).
von Mansfelde, Alexander S., M.D., "Quality Hill," Ashland, Neb. (50). F G H K
*von Nardroff, Ernest R., 360a Tompkins Ave., Brooklyn, N. Y. (44). 1896. B
*von Schrenk, Hermann, Shaw School of Botany, St. Louis, Mo. (49). 1901. G
*Voorhees, Louis A., P. O. Box 290, New Brunswick, N. J. (43). 1895. C
Voris, Floyd Thomas, Professor of Natural Science, Buena Vista College, Storm Lake, Iowa. (50). B
Votey, J. William, Professor of Civil Engineering, University of Vermont, Burlington, Vt. (50). D
Vreeland, Frederick K., E.E., Box 1877, New York, N. Y. (50). B D G
Waddell, Montgomery, 135 Broadway, New York, N. Y. (51). D
Wadman, W. E., 102 Lord Ave., Bayonne, N. J. (50).
*Wadsworth, M. Edw., Professor of Mining and Geology, Penna. State Coll., State College, Pa. (23). 1874. E

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Wadsworth, William Austin, Genesee, Livingston Co., N. Y. (50). **G**

*Wagner, Frank C., Rose Polytechnic Institute, Terre Haute, Ind. (34). 1897. **D**

Wagner, George, 1205 E. University Ave., Ann Arbor, Mich. (46). **C F G**

Waite, Frederick Clayton, Ph.D., Asst. Prof. of Histology and Embryology, Medical Department, Western Reserve Univ., Cleveland, Ohio. (50). **F K**

*Walcott, Charles D., Director U. S. Geol. Survey, Washington, D. C. (25). 1882. **E F**

*Waldo, Prof. Clarence A., Purdue University, Lafayette, Ind. (37). 1889. **A**

*Waldo, Leonard, 520 Stelle Ave., Plainfield, N. J. (28). 1880. **A**

Wales, Salem H., 25 E. 55th St., New York, N. Y. (36).

Walker, Byron Edmund, Toronto, Can. (38). **E**

Walker, Charles R., M. D., Concord, N. H. (50). **K**

Walker, George C., Room 367 Rookery Building, Chicago, Ill. (17).

Walker, James, 49 Maiden Lane, New York, N. Y. (43).

Walker, John A., E.M., 260 Montgomery St., Jersey City, N. J. (50). **C D E I**

Wallace, Edwin Corby, Ph.G., Foot of Sixth St., Long Island City, N. Y. (47).

*Waller, E., 7 Franklin Place, Morristown, N. J. (23). 1874.

Walsh, Thomas F., Le Roy and Phelps Place, Washington, D. C. (49). **D**

Walter, Miss Emma, 109 North 16th St., Philadelphia, Pa. (50). **E**

Walter, W. J., 115 West 57th St., New York, N. Y. (50).

Wantland, C. E., Land Agent, U. P. R. R. Co., 1025 17th St., Denver, Colo. (50). **E**

Ward, Frank A., 16–26 College Ave., Rochester, N. Y. (40).

*Ward, Henry A., 620 Division St., Chicago, Ill. (13). 1875. **E F H**

*Ward, Prof. Henry B., University of Nebraska, Lincoln, Nebr. (48). 1899. **F**

Ward, J. Langdon, 120 Broadway, New York, N. Y. (29). **I**

*Ward, Lester F., U. S. Geol. Survey, Washington, D. C. (26). 1879. **E G**

Ward, Milan Lester, Professor of Mathematics and Astronomy, Ottawa Univ., Ottawa, Kansas. (50). **A**

Ward, Robert De C., Harvard Univ., Cambridge, Mass. (47).

*Ward, Dr. R. H., 53 Fourth St., Troy, N. Y. (17). 1874. **F G**

Ward, Willard Parker, Ph.D., Mining Engineer, 164 West 58th St., New York, N. Y. (50). **D E**

*Warder, Prof. Robert B., Howard University, Washington, D. C. (19). 1881. **B C**

Wardle, Harriet N., 125 N. 10th St., Philadelphia, Pa. (47). **E H**

Ware, Miss Mary L., 41 Brimmer St., Boston, Mass. (47).

*Ware, Wm. R., School of Architecture, Columbia University, New York, N. Y. (36). 1901. **D**

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*WARINGTON, ROBERT, F.R.S., Rothamsted, Harpenden, England. (40). 1899. C

Warner, Charles F., 837 State St., Springfield, Mass. (45). B

*WARNER, JAMES D., 463 E. 26th St., Flatbush, Brooklyn, N. Y. (18). 1874. A B

*Warner, Worcester R., 1722 Euclid Ave., Cleveland, Ohio (33). 1888. A B D

Warren, Rt. Rev. Henry White, Bishop M. E. Church, University Park, Colo. (50). A

*Warren, Prof. Howard C., Princeton Univ., Princeton, N.J. (46). 1901. H K

*Warren, Joseph W., M.D., Bryn Mawr, Pa. (31). 1886. F

Warren, Mrs. Susan C., 67 Mt. Vernon St., Boston, Mass. (29).

*Warren, S. Edward, Newton, Mass. (17). 1875. A I

Warren, William R., 81 Fulton St., New York, N. Y. (49).

Warrington, James N., 1711 South Hope St., Los Angeles, Cal. (34). A B D

*Washington, Dr. Henry S., Locust, N. J. (44). 1897. E

Waterhouse, James Smartt, Professor of Chemistry and Natural Science, Cumberland University, Lebanon, Tenn. (50). F G C

Watson, Benj. Mauston, Bussey Institution, Jamaica Plain, Mass. (50).

Watson, Miss C. A., North Andover, Mass. (31). D

Watson, Miss E. A., 1 W. 72d St., New York, N. Y. (49).

Watson, Joseph Ralph, Professor of Natural Sciences, Berea College, Berea, Ky. (50). G

Watson, Thomas A., Weymouth, Mass. (42). E

*WATSON, PROF. WM., 107 Marlborough St., Boston, Mass. (12). 1884. A

Watters, William, A.M., M.D., 26 S. Common St., Lynn, Mass. (40). E G

Watterson, Miss Ada, 153 W. 84th St., New York, N. Y. (49). G

*Wead, Charles K., U. S. Patent Office, Washington, D. C. (47). 1898. B

Weatherly, Ulysses Grant, Professor of Economics, University of Indiana, Bloomington, Ind. (50). I

Weaver, Gerrit E. Hambleton, 916 Farragut Terrace, West Philadelphia, Pa. (38). G I

Webb, Howard Scott, Professor of Electrical Engineering, University of Maine, Orono, Maine. (50). D

*Webb, Prof. J. Burkitt, Stevens Institute, Hoboken, N. J. (31). 1883. A B D

*Webber, Herbert J., U. S. Dep't Agriculture, Washington, D. C. (47). 1900. G

*Weber, Prof. Henry A., Ohio State Univ., Columbus, Ohio (35). 1888. C

Webster, Albert Lowry, C.E., Consulting Civil and Sanitary Engineer, 112 East 40th St., New York, N. Y. (50). C D

*Webster, Prof. Arthur Gordon, Clark University, Worcester, Mass. (47). 1898. A B

Webster, Edgar H., Professor of Physical Science, Atlanta University, Atlanta, Ga. (50). B

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*Webster, Prof. F. M., Agric. Exper. Station, Wooster, Ohio. (35). 1890. **F**
Webster, Mrs. N. B., Vineland, N. J. (43).
*Weed, Clarence M., Ph.D., Durham, N. H. (38). 1890. **F**
Weed, J. N., 244 Grand St., Newburgh, N. Y. (37). **E I**
Weeks, Edwin Ruthven, Consulting Engineer, 3408 Harrison St., Kansas City, Mo. (50). **A B D I**
*Weems, J. B., Ph.D., Agric'l College, Ames, Iowa (44). 1900. **C**
Weick, Charles W., Columbia University, New York, N. Y. (48). **D**
Weinzirl, John, Vice Director, Hadley Clim. Lab., Univ. of New Mexico, Albuquerque, New Mex. (45). **G**
*Welch, William Henry, M.D., 935 St. Paul St., Baltimore, Md. (47). 1900. **F H**
Welin, John E., Professor of Physics and Chemistry, Bethany College, Lindsborg, Kansas. (50). **B C E**
Wells, Eliab Horatio, M.D., Professor of Natural Science, Baylor Female College, Belton, Texas. (50). **F K**
Wells, Frank, M.D., 178 Devonshire St., Boston, Mass. (47). **C**
Wells, Samuel, 45 Commonwealth Ave., Boston, Mass. (24). **H**
Wells, William H., Jr., 2 Norfolk St., Strand, W. C., London, England. (39). **E**
Wernicke, Prof. Paul, 411 S. Limestone St., Lexington, Ky. (44). **A B**
Wesson, David, Mgr. and Treas. Wesson Process Co., Savannah, Ga. (50). **C**
West, Haarlem Ethneen, Mining Engineer, General Manager Pacific Northwest Mining Corporation, Libby, Mont. (50). **D**
Westinghouse, George, Pittsburg, Pa. (50). **D**
*Weston, Edward, 645 High St., Newark, N. J. (33). 1887. **B C D**
Weston, Wilbur H., Newburgh, N. Y. (50). **E I**
Wetzler, Joseph, 240–242 W. 23d St., New York, N. Y. (36).
Weygant, Colonel Charles H., Newburgh, N. Y. (50). **I**
*Wheeler, Alvin Sawyer, Ph.D., Assistant Professor of Chemistry, University of North Carolina, Chapel Hill, N. C. (50). 1901. **C**
*Wheeler, Eben S., U. S. Engineer Office, Detroit, Mich. (50). 1901. **D**
*Wheeler, Henry Lord, Sheffield Lab., New Haven, Conn. (50). 1901. **C**
Wheeler, Schuyler Skaats, Ampere, N. J. (50). **D**
Wheeler, William, C.E., Concord, Mass. (41).
*Wheeler, William Morton, Professor of Zoology, University of Texas, Austin, Texas. (50). 1901. **F**
Whitaker, Milton C., Columbia Uniuersity, New York, N. Y. (50).
White, Charles G., Lake Linden, Mich. (46). **B C**
White, Charles H., U. S. N., Center Sandwich, N. H. (34). **C**
*White, David, U. S. Geol. Survey, Washington, D. C. (40). 1892. **E F**
*White, Horace, Editor *New York Evening Post*, 18 West 69th St., New York, N. Y. (50). 1901. **I**
*White, H. C., Ph.D., University of Georgia, Athens, Ga. (29). 1885. **C**

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*WHITE, PROF. I. C., State Geologist of West Virginia, Morgantown, W. Va. (25). 1882. **E**

White, John Williams, 18 Concord Ave., Cambridge, Mass. (47).

White, LeRoy S., 19 Buckingham Ave., Waterbury, Conn. (23).

White, Thaddeus R., 257 W. 45th St., New York, N. Y. (42). **A**

*Whiteaves, J. F., Geological Survey, Ottawa, Canada. (31). 1887. **E F**

*Whitfield, J. Edward, 406 Locust St., Philadelphia, Pa. (44). 1896. **C**

*Whitfield, R. P., Amer. Mus. Nat. History, Central Park, New York, N. Y. (18). 1874. **E F H**

Whiting, S. B., 11 Ware St., Cambridge, Mass. (33). **D**

*Whiting, Miss Sarah F., Wellesley College, Wellesley, Mass. (31). 1883. **A B**

*Whitman, Prof. Charles O., University of Chicago, Chicago, Ill. (43). 1898. **F**

*Whitman, Prof. Frank P., Adelbert College, Cleveland, Ohio (33). 1885. **A B**

*Whitney, Miss Mary W., Vassar College, Poughkeepsie, N. Y. (47). 1900. **A**

*Whitney, Willis Rodney, Mass. Inst. Tech., Boston, Mass. (46). 1900. **C**

Whitted, Thomas Byrd, General Elec. Co., Denver, Colo. (50). **D**

Whittemore, Willliams C., 1526 N. H. Ave., Washington, D. C. (49).

Wiechmann, F. G., M.D., 771 West End Ave., New York, N. Y. (50). **K**

*Wiegand, Karl McKay, Ph.D., Cornell University, Ithaca, N. Y. (45). 1899. **G**

Wightman, Merle J., Electrical Engineer, 150 Nassau St., New York, N. Y. (50). **D**

Wilbour, Mrs. Charlotte B., 40 Central Park, South, New York, N. Y. (28).

*Wilbur, A. B., Middletown, N. Y. (23). 1874. **E**

*Wilbur, Ray Lyman, M.D., Assistant Professor of Physiology, Stanford University, Cal. (50). 1901. **K**

*Wilcox, Edwin Mead, Ph.D., Prof. of Biology, Ala. Poly. Inst., Auburn, Ala. (50). 1901. **F G**

Wilcox, Miss Emily T., Middletown, Conn. (33). **A B**

*Willcox, Miss Mary Alice, Ph.D., Professor of Zoology, Wellesley College, Wellesley, Mass. (50). 1901. **F**

*Willcox, Walter F., Ph.D., Professor of Economics, Cornell University, Ithaca, N. Y. (50). 1901. **I**

Wilcox, William W., Inventor and Manufacturer, 187 South Main St., Middletown, Conn. (50). **D I**

*Wiley, Harvey W., Ph.D., U. S. Dep't. Agriculture Washington, D. C. (21). 1874. **C**

Wiley, William H., C. E., 43 E. 19th St., New York, N. Y. (50). **D E**

Wilkins, Wm. Glyde, C. E., Professor of Mining Engineering, Western Univ. of Penna., Pittsburg, Pa. (50). **D E**

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Wilkinson, John G., Newburgh, N. Y. (50). **A**

Wilkinson, Levi Washington, Professor of Industrial and Sugar Chemistry, Tulane, University, New Orleans, La. (50). **C**

Willard, Julius Terrass, Dir. Kans. State Exp't Sta., Manhattan, Kans. (50). **C**

Willetts, Joseph C., Skaneateles, N. Y. (29). **E F H**

*Williams, Benezette, 153 La Salle St., Chicago, Ill. (33). 1887. **D**

Williams, Charles B., North Carolina Dep't of Agr., Raleigh, N. C. (47).

*Williams, Charles H., M.D., 15 Arlington St., Boston, Mass. (22). 1874.

Williams, Charles S., 166 Montgomery St., Newburgh, N. Y. (50). **I**

*Williams, Prof. Edw. H., Jr., 117 Church St., Bethlehem, Pa. (25). 1894. **D E**

*Williams, Francis H., M.D., 505 Beacon St., Boston, Mass. (29). 1890.

Williams, Frank H., Greene, N. Y. (50). **D**

*Williams, Prof. Henry Shaler, Yale University, New Haven, Conn. (18). 1882. **E F**

*Williams, Dr. J. Whitridge, Professor of Obstetrics, Johns Hopkins University, Baltimore, Md. (50). 1901. **K**

Williams, Miss Kate Elizabeth, 1450 Pearl St., Denver, Colo. (50). **E F I**

Wlliams, Stephen Riggs, Professor of Biology, Miami University, Oxford, Ohio. (50). **F**

Williamson, Edward Bruce, Bluffton, Ind. (50). **F**

Williamson, G. A., 14 Dey St., New York, N. Y. (49).

Williamson, Mrs. M. Burton, 1060 W. Jefferson St., Los Angeles, Cal. (44). **F**

*Willis, Bailey, U. S. Geological Survey, Washington, D. C. (36). 1890. **E**

*Willoughby, Charles C., Peabody Museum, Cambridge, Mass. (45). 1897. **H**

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WEST FAIRVIEW.

Bashore, Harvey B.

WILKES-BARRE.

Dean, William H., 167 West River Street.
Ricketts, R. Bruce.

PHILIPPINE ISLANDS.

CAVITE.

Winterhalter, A. G., Naval Station.

MANILA.

McCauley, C. A. H.
Worcester, Dean C.

PORTO RICO.

PONCE.

Domenech, Manuel V., Lock Box 220.

SAN JUAN.

Berkeley, William N., Box 65.
Delafond, E., P. O. Box 252.
Vogdes, A. W., San Cristobal.

RHODE ISLAND.

KINGSTON.

Card, Fred W.
Merrow, Miss Harriet L., College of Agriculture and Mechanic Arts.
Scott, Arthur Curtis.

MATUNUCK.

Matlack, Charles, "Hidden Hearth."

NEWPORT.

Emmons, Arthur B.
Gibbs, Wolcott.
Josephs, Lyman C., Box 311.
Mearns, Edgar A., Fort Adams.

PEACE DALE.

Hazard, R. G.

PROVIDENCE.

Adams, Frederick C., Classical High School.

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Appleton, John Howard, Brown University.
Barus, Carl, Wilson Hall, Brown University.
Bumpus, H. C., Brown University.
Cady, Walter G., 127 Power Street.
Catlin, Charles A., 133 Hope Street.
Delabarre, E. B., Brown University.
Field, George Wilton, 233 Medway Street.
Hill, John Edward, Brown University.
Lowell, Russell C., 167 Ohio Ave.
Marlatt, Miss Abby L., Manual Training High School.
Packard, A. S., 115 Angell Street.
Palmer, Albert De Forest, Brown University.
Slocum, Frederick, Ladd Observatory.
Tilley, Charles Edward, Hope Street High School.
Upton, Winslow, Ladd Observatory.
Woodward, William Carpenter, 5 Charles Field Street.

WOONSOCKET.

Marble, Miss Sarah.

SOUTH CAROLINA.

CHARLESTON.

Ashley, Geo. H., College of Charleston.

CLEMSON COLLEGE.

Barnes, Albert.
Brackett, Richard N.
Lewis, Joseph Volney.
Riggs, Walter M.

SPARTANBURG.

Knox, Francis H.

SOUTH DAKOTA.

BROOKINGS.

Chilcott, Ellery C., Agricultural College.
Heston, John W., Agricultural College.

HURLEY.

Ellis, Robert W.

MITCHELL.

Fullmer, Edward Lawrence, Dakota University.

RAPID CITY.

O'Harra, C. C., State School of Mines.
Slagle, Robert Lincoln.

REDFIELD.

Arnold, Jacob H., Redfield College.

SPEARFISH.

Alexander, Curtis.

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Droppers, Garrett.
Todd, James E.

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Dabney, Chares W., University of Tennessee.
Futon, Weston Miller, University of Tennessee.
Perkins, Charles Albert, University of Tennessee.

LEBANON.

Waterhouse, James Smartt, Cumberland University.

MEMPHIS.

Cook, James B., Randolph Building.

NASHVILLE.

Buist, John Robinson.
Daniel, John, Vanderbilt University.
Dudley, William L., Vanderbilt University.
Glenn, L. C., Vanderbilt University.
Hollinshead, Warren H., Vanderbilt University.
Kelley, John Harris, 315 North Vine Street.
Kirk, Elliott W., Wesley Hall.
McGill, John T., Vanderbilt University.
Thruston, Gates Phillips.

SEWANEE.

Barton, Samuel M., University of the South.
Quintard, Edward A.

TEXAS.

AUSTIN.

Bray, William L., University of Texas.
Duval, Edmund P. R., 2006 University Avenue.
Halsted, George Bruce, 2407 Guadalupe Street.
Harper, Henry Winston, University of Texas.
Lowber, James William, 113 East 18th Street.
Mezes, Sidney Edward, University of Texas.
Prather, William L., 1914 Nueces Street.
Sutton, W. S., 1812 Congress Avenue.
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Smith, Q. Cincinnatus, 617 Colorado Street.
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Fuller, Arthur Levens.

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Ness, Hege, Agricultural and Mechanical College.
Price, Robert Henderson, Agricultural and Mechanical College.
Tilson, P. S., Agricultural and Mechanical College.

COLUMBUS.

Harrison, Robert Henry.
Simpson, French, Jr.

CORPUS CHRISTI.

Spohn, Arthur Edward.

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Munson, T. V.

DENTON.

Long, William H., Jr.

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Heller, Napoleon B., Forth Worth University.

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Dudgeon, H. R., School of Medicine, University of Texas.
Jones, Charles C.
Smith, Allen J., School of Medicine, University of Texas.
Thompson, James Edwin, 3224 Broadway.

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GRAHAM.

Le Grand, Leroy.

HEMSTEAD.

Montgomery, Edmund.

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Dumble, E. T., 1708 Prairie Avenue.

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Halley, Robert Burns, Sam Houston Normal Institute.

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WEATHERFORD.

Curtis, George W.

WHITEWRIGHT.

Butler, Frank Edward, Grayson College.

YOAKUM.

Shropshire, Walter.

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SALT LAKE CITY.

Anderson, Frank, 255 2nd East Street.
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Jenney, Walter Proctor, Kuntsford Hotel.
Jones, Marcus E.
Merrill, Joseph Francis, University of Utah.
Reynolds, George, P. O. Box B.
Talmage, James Edward, University of Utah.

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Freedman, William Horatio, University of Vermont.
Jones, Lewis R.
Perkins, George H.
Taft, Elihu B.
Votey, J. William, University of Vermont.

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Ham, Judson B., State Normal School.

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Francisco, M. Judson, 49 Merchants Row.

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Hazen, Tracy Elliott, Fairbanks Museum.

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Hodge, James M.

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Pritchard, Samuel Reynolds.
Randolph, L. S.

BLACKSTONE.

Fishburne, Edward B., Jr.

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Stone, Ormond, University of Virginia.
Tuttle, Albert H., University of Virginia.

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Bayby, J. H. C., Hampden-Sidney College.

HOLLINS.

Duke, Frank Williamson, Hollins Institute.

LEXINGTON.

Howe, James Lewis, Washington and Lee University.
Stevens, W. LeConte, Washington and Lee University.

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Hunter, Joseph Rufus, Richmond College.
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Eccles, David C.
Shedd, Solon.

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Doubt, Thomas E., University of Washington.
Millis, John.
Roberts, Milnor, University of Washington.
Shelton, Edward M., 2728 Baylston Avenue.

TACOMA.

Gault, Franklin B., 602 North I Street.

WEST VIRGINIA.

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Goodwin, Elmer Forrest, State Normal School.

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Sharp, Charles Cutler, Raven Coal and Coke Company.

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Brooks, Earle Amos.

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Brown, Samuel B.
Davis, Kary C., 628 North High Street.
Fast, Richard Ellsworth, West Virginia University.
Hodges, Thomas Edward, West Virginia University.
Hopkins, A. D., West Virginia University.
Jones, Clement Ross, West Virginia University.
Maxwell, Hu.
Morris, Russell Love, West Virginia University.
Patterson, Chas. H., West Virginia University.
Stewart, James H., Agricultural Experiment Station.
White, I. C., West Virginia University.

PHILIPPI.

Lemley, C. McC.

SISTERSVILLE.

Hennen, Ray V., care Carter Oil Co.

WHEELING.

Crockard, Frank Hearne, Lock Box 34.

WISCONSIN.

BELOIT.

Smith, Erastus G., Beloit Sanitary Laboratory.
Smith, Thomas A., Beloit College.

GREEN BAY.

Schuette, J. H.

JANESVILLE.

Folkmar, Daniel, 5 Glen Etta Street.

MADISON.

Babcock, S. Moulton, 432 Lake Street.
Bull, Storm.
Cheney, Lellen Sterling, 318 Bruen Street.
Comstock, George C., University of Wisconsin.
Flint, Albert S., Washburn Observatory.
Frost, William Dodge, University of Wisconsin.
Goff, E. S., 1113 University Avenue.
Hillyer, Homer W., University of Wisconsin.
Hobbs, William Herbert.

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Jastrow, Joseph, University of Wisconsin.
Johnson, John B.
Kahlenberg, Louis, 306 Lake Street.
Kremers, Edward, University of Wisconsin.
Longden, A. C., Wisconsin Avenue.
King, F. H., Experiment Station.
Mendenhall, Charles E., University of Wisconsin.
Miller, William S., University of Wisconsin.
Russell, H. L., University of Wisconsin.
Snow, Benjamin W., 518 Wisconsin Avenue.
Trowbridge, Augustus, University of Wisconsin.
Van Hise, Charles R., University of Wisconsin.
Woll, Fritz Wilhelm.

MILWAUKEE.

Becher, Franklin A., 234 Oneida Street.
Case, Ermine Cowles, State Normal School.
Schlichting, Emil, 646 Broadway.
Sherman, Lewis, 448 Jackson Street.
Stickney, Gardner P., care Oliver C. Fuller & Company.
Wright, Clement Blake Bergen, 796 Astor Street.

NORTH FREEDOM.

LaRue, William Gordon.

RACINE.

Davis, J. J., 1119 College Avenue.

RIPON.

Chandler, Charles Henry.
Marsh, C. Dwight.

WILLIAMS BAY.

Barnard, Edward E., Yerkes Observatory.
Frost, Edwin Brant, Yerkes Observatory.
Hale, George E., Yerkes Observatory.
Kent, Norton Adams, Yerkes Observatory.

WYOMING.

CARBON.

Carter, James.

FOUR BEAR.

Pickett, William Douglas.

LARAMIE.

Nelson, Aven, University of Wyoming.
Slosson, Edwin E., University of Wyoming.

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FOREIGN.

ARGENTINE REPUBLIC.

BUENOS AIRES.

Corthell, Elmer L., care Ministerio de Obras Publicas.

BRAZIL.

SAO PAULO.

Derby, Orville A.
Lane, Horace Manley, Caixa 14.
von Ihering, F., Musen Paulista.

BRITISH COLUMBIA.

ROSSLAND.

Thompson, William, Rossland Great Western Mines, Limited.

VICTORIA.

Sutton, William J.

CANADA.

ACTON VALE.

Würtele, John Hunter.
Würtele, Louis C.

BARRIE.

Hunter, Andrew Frederick.

DAWSON.

Tyrrell, Joseph B.

GUELPH.

Mills, James, Ontario Agricultural College.

HALIFAX.

Murray, Daniel A., Dalhousie College.

MACLEOD.

Wilson, Robert N.

MONTREAL.

Burgess, Thomas J. W., Protestant Hospital for the Insane.
Iles, George, 5 Brunswick Street.
Lampard, Henry, 102 Shuter Street.
Lyman, Henry H., 74 McTavish Street.
Mills, Wesley, McGill University.

OTTAWA.

Bell, Robert, Geological Survey.
Fletcher, James, Experimental Farm.
Harmon, Miss A. Maria, 171 McLaren Street.
Klotz, Otto Julius, 437 Albert Street.
Saunders, Charles E., Experimental Farm.

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Saunders, William, Experimental Farm.
Whiteaves, J. F., Geological Survey.

QUEBEC.

Laflamme, J. C. K., Laval University.

SAWYERVILLE.

Moore, Mrs. A. H.

TORONTO.

Butler, Matthew J., 22 Wellington Place.
Galbraith, John, School of Practical Science.
James, Charles C., Department of Agriculture.
Kammerer, Jacob Andrae.
Kirschmann, A., Toronto University.
Spencer, J. William, 152 Bloor Street.
Walker, Byron Edmund.

ENGLAND.

LAMPETER.

Scott, Arthur William, St. David's College.

LONDON.

Power, Frederick B., 6 King Street, Snow Hill, E. C.
Wells, Wm. H., Jr., 2 Norfolk St., Strand W. C.

OXFORD.

Myres, John L., Christ Church.

ROTHAMSTED.

Warington, Robert.

FRANCE.

PARIS.

Loubat, Le Duc De, 47 rue Dumont d'Urville.

GERMANY.

BERLIN.

Hoffmann, Friedrich, Charlottenburg, Kant Street 125.
Magee, Louis J., Grosse Quer Allee 1.

HUNGARY.

BUDAPEST.

Krécsy, Béla, VI Bulyovsxky u. 22.

ITALY.

SAN REMO.

Kuntze, Otto, Villa Girola.

JAPAN.

TOKYO.

Loew, Oscar.

YOKOHAMA.

Gause, Fred Taylor.

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MEXICO.

AGUASCALIENTES.

Morse, Willard S.

CITY OF MEXICO.

Hard, James M. B., Cordobanes 16
Sercombe, Parker H., 1ª Calle San Francisco No. 8.

CORDOBA.

Bowman, Joseph H.

DURANGO.

Carnaghan, Edward D.

GUADALAJARA.

Schiaffino, Mariano L.

GUADALUPE Y CALVO.

Schiertz, Ferdinand A.

JALAPA.

Gutierrez, Manuel R.

LINARES.

McLimont, Andrew W.

MONTEREY.

Dysterud, E.

PACHUCA.

De Landero, Carlos F.

SAN JOSÉ DE GRACIA.

Tays, Eugene A. H., Anglo-Merican Mining Co.

SOMBRERETE.

McMahan, Charles Hays.

TORRES.

Peterson, Bertel.

NICARAGUA.

LEON.

Crawford, John.

SICILY.

CATANIA.

Scaife, Walter B., care A. W. Elford.

SOUTH AFRICA.

CAPE TOWN.

Mally, Charles William, Department of Agriculture.

TURKEY.

HARPUT.

Norton, Thomas H., United States Consullate.

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DECEASED MEMBERS.

[A list of deceased members of the Association, so far as known at the time of publishing the volume of Proceedings of the Springfield meeting, May, 1896, is given in that volume. At the Buffalo meeting the Council directed the Permanent Secretary to omit the printing of the full list of deceased members in the annual volumes and to print only the additions to the list. Since the publication of the list printed in the New York Proceedings, Vol. 49, notices have been received of the decease of the following members.]

Andrews, E. R., Rochester, N. Y. (41). Died August 13, 1900. Age, 72.

Appleton, Rev. Edw., D.D., Ashbourne, Pa. (28).

Batterson, J. G., Hartford, Conn. (23). Died September 18, 1901.

Bonwill, W. G. A., D.D.S., 2009 Chestnut St., Philadalphia, Pa. (47).

Burr, Mrs. Laura E., Commercial Hotel, Lansing, Mich. (34). Died May May 18, 1900.

Claypole, Prof. Edward W., Polytechnic Institute, Pasadena, Cal. (30). Died August 17, 1901.

Cope, Thos. P., Awbury, Germantown, Pa. (33). Died October 22, 1900.

Dawson, Geo. M., S.Sc., F.G.S., Geol. Survey, Ottawa, Canada. (38). Died March 2, 1901.

Duffield, John T., D.D., LL.D., Princeton University, Princeton, N. J. (50). Died April, 1901.

Egleston, Prof. Thomas, 35 W. Washington Square, New York, N. Y. (27).

Foster, L. L., Agric. and Mech. College, College Station, Texas. (50).

Gaffield, Thomas, 54 Allen St., Boston, Mass. (29). Died December 6, 1900.

GARLAND, JAMES, 2 Wall St., New York, N. Y. Died July 27, 1900.

GRANT, MRS. MARY J., 36 Division St., Danbury, Conn. (23). Died December 23, 1900.

Haliburton, R. G., Q.C., 143 John St.. Toronto, Canada. (43).

Hubbard, C. S., M.D., 44 Congress St., Bradford, Pa. (49). Died February 6, 1901.

Hudson, John Elbridge, 125 Milk St., Boston, Mass. (49). Died October 1, 1900.

Hulst, Rev. Geo. D., 15 Himrod St., Brooklyn, N. Y. (29). Died November, 5, 1900.

Humphrey, Daniel, M.D., Lawrence, Mass. (18). Died May 9, 1901.

Keeler, Prof. James E., Lick Observatory, Mt. Hamilton, Cal. (47).

Kinder, Sarah A., 28 Dockerbie St., Indianapolis, Ind. (39). Died October 23, 1900.

Koch, Henry C. F., 224 Lenox Ave., New York, N. Y. (49). Died September, 1900.

Lawton, George K., U. S. Naval Observatory, Washington, D. C. (49).

Le Conte, Prof. Joseph, University of California, Berkeley, Cal. (29).

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Born in Liberty County, Georgia, February, 1823. Died in Yosemite Valley, July 6, 1901.

Lowell, Augustus, 53 State St., Boston, Mass. (29). Died June 22, 1900.

Ludlow, William, General U. S. Army, New York, N. Y. (33). Died August 30, 1901.

Lugger, Dr. Otto, State Agric. Exper. Station, St. Anthony Park, Minn. (47). Died May 21, 1901.

Lyon, Dr. Henry, 34 Monument Square, Charlestown, Mass. (18).

Meehan, Thomas, Germantown, Pa. (17).

Mohr, Dr. Charles, Asheville, N. C. (40). Died July 17, 1901.

Murphy, Edward, M.D., New Harmony, Indiana. (39). Died December, 1900.

Myers, John A., Anderson Bldg., New York, N. Y. Died April 8, 1901.

Parsons, C. Chauncey, 43 Sedgwick St., Brooklyn, N. Y. (47). Born in Boston, Mass., June 18, 1840. Died at Hempstead, L. I., January 16, 1901.

Pell, Alfred, New York, N. Y. (50). Died March 20, 1901.

Rowland, Prof. Henry A., Baltimore, Md. (29). Died April 16, 1901.

Safford, Prof. Truman H., 112 N. Broad St., Newark, N. J. (41). Born at Royalton, Vt., in 1836. Died at Williamstown, Mass., June 19, 1901. Occupied Chair of Astronomy at Williams College since 1876.

Squibb, Edward R., M.D,, 152 Columbia Heights, Brooklyn, N. Y. (43). Died October 25, 1900.

THOMPSON, FREDERICK F., Canandaigua, N. Y. (36).

Trenholm, Hon. W. L., 160 Broadway, New York, N. Y. (35).

Vail, Prof. Hugh D., Santa Barbara, Cal. (18). Died June 28, 1900.

Voorhees, Charles H., M.D., New Brunswick, N. J. (29). Died May 13, 1900.

Waring, John, 141 Washington St., Hartford, Conn. (33). Died June 9, 1901.

WATERS, GEORGE F., Boston, Mass. (29).

Webster, Prof. N. B., Vineland, N. J. (7). Born in Unity, N. H., June 13, 1821. Died in Vineland, N. J., December 27, 1900.

Wheeler, T. B., M.D., 123 Metcalfe St., Montreal, Canada. (11). Died January 10, 1901.

White, Theodore Greeley, Ph.D., Columbia University, New York, N.Y. (47). Died July, 1901.

Williams, Prof. Thomas A., U. S. Dep't of Agriculture, Washington, D. C. (42). Died December 23, 1900.

Youmans, Wm. Jay, M.D., 72 Fifth Ave., New York, N. Y. (28). Died April 10, 1901.

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ADDRESS

BY

R. S. WOODWARD,

THE RETIRING PRESIDENT OF THE ASSOCIATION.

THE PROGRESS OF SCIENCE.

A constitutional provision of our Association stipulates that "It shall be the duty of the President to give an address at a General Session of the Association at the meeting following that over which he presided." Happily for those of us who must in turn fulfill this duty, the scientific foresight of our predecessors set no metes and bounds with respect to the subject-matter or the mode of treatment of the theme that might be chosen for such an address. So far, therefore, as constitutional requirements are concerned, a retiring president finds himself clothed for the time being with a degree of liberty which might be regarded as dangerous, were it not for an unwritten rule that one may not hope to enjoy such liberty more than once. But time and place, nevertheless, as well as the painful personal limitations of any specialist, impose some rather formidable restrictions. One may not tax lightly, even, in a summer evening, the patience of his audience for more than an academic hour, the length of which in most cases is less than sixty minutes. One must confine himself to generalities, which, though scientifically hazardous, serve as a basis for semi-popular thought; and one must exclude technical details, which, though scientifically essential, tend only to obscure semi-popular presentation. Courtesy, also, to those who are at once our hosts and our guests requires that, so far as possible, one should substitute the vernacular for the 'jargon of

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science,' and draw his figures of speech chiefly from the broad domain of every-day life rather than from the special, though rapidly widening, fields of scientific activity.

Between this nominally unlimited freedom on the one hand, and these actually narrow restrictions on the other, I have chosen to invite your attention for the hour to a summary view of the salient features of scientific progress, with special reference to its effects on the masses, rather than on the individuals, of mankind. We all know, at least in a general way, what such progress is. We are assured almost daily by the public press and by popular consent that the present is not only an age of scientific progress, but that it is preeminently the age of scientific progress. And with respect to the future of scientific achievement, the consensus of expert opinion is cheerfully hopeful, and the consensus of public opinion is extremely optimistic. Indeed, to borrow the language sometimes used by the rulers of nations, it may be said that the realm of science is now at peace with all foreign parts of the world, and in a state of the happiest domestic prosperity.

But times have not been always thus pleasant and promising for science. As we look backward over the history of scientific progress it is seen that our realm has been taxed often to the utmost in defense of its autonomy, and that the present state of domestic felicity, bordering on tranquillity, has been preceded often by states of domestic discord bordering on dissolution. And, as we look forward into the new century before us, we may well enquire whether science has vanquished its foreign enemies and settled its domestic disputes for good and all, or whether future conquests can be made only by a similarly wasteful outlay of energy to that which has accompanied the advances of the past. Especially may we fitly enquire on an occasion like the present what are the types of mind and the methods of procedure which make for the progress, and what are the types of mind and the methods of procedure which make for the regress, of science. And I venture to think that we may enquire also with profit, in some prominent instances, under what circumstances in the past science has waxed or waned, as the case may be, in its

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slow rise from the myths and mysticism of earlier eras to the law and order of the present day. For it is a maxim of common parlance, too well justified, alas! by experience, that history repeats itself; or, to state the fact less gently, that the blunders and errors of one age are repeated with little variation in the succeeding age. This maxim is strikingly illustrated by the history of science, and it has been especially deeply impressed upon us—burnt in, one might say—by the scientific events of our own times. Have we not learned, however, some lasting lessons in the hard school of experience, and may we not transmit to our successors along with the established facts and principles of science the almost equally well established ways and means for the advancement of science? Will it be possible for society to repeat in the twentieth century the appalling intellectual blunders of the nineteenth century, or have we entered on a new era in which, whatever other obstacles are pending, we may expect man to stand notably less in his own light as regards science than ever before? To a consideration of these and allied questions I beg your indulgence, even though I may pass over ground well known to most of you, and encroach, perhaps, here and there, on prominences in fields controversial; for it is only by discussion and rediscussion of such questions that we come at last, even among ourselves in scientific societies, to the unity of opinion and the unity of purpose which lead from ideas to their fruitful applications.

From the earliest historic times certainly, if not from the dawn of primitive humanity, down to the present day, the problem of the universe has been the most attractive and the most illusive subject of the attention of thinking men. All systems of philosophy, religion and science are alike in having the solution of this problem for their ultimate object. Many such systems and sub-systems have arisen, flourished and vanished, only to be succeeded by others in the seemingly Sisyphean task. Gradually, however, in the lapse of ages there have accumulated some elements of knowledge which give inklings of partial solutions; though it would appear that the best current opinion of philosophy, religion and science would again agree in the conclusion that we are yet immeasurably

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distant from a complete solution. Almost equally attractive and interesting, and far more instructive, as it appears to me, in our own time, is the contemplation of the ways in which man has attacked this perennial riddle. It is, indeed, coming to be more and more important for science to know how primitive, barbarous and civilized man has visualized the conditions of, and reached his conclusions with respect to, this problem of the centuries; for it is only by means of a lively knowledge of the baseless hypotheses and the fruitless methods of our predecessors that we can hope to prevent history from repeating itself unfavorably.

Looking back over the interval of two to three thousand years that connects us by more or less authentic records with our distinguished ancestors, we are at once struck by the admirable confidence they had acquired in their ability to solve this grand problem. Not less admirable, also, for their ingenuity and for the earnestness with which they were advanced, are the hypotheses and arguments by which men satisfied themselves of the security of their tenets and theories. Roughly speaking, it would appear that the science of the universe received its initial impulse from earliest man in the hypothesis that the world is composed of two parts; the first and most important part being in fact, if not always so held ostensibly, himself, and the other part being the aggregate of whatever else was left over. Though dimly perceived and of little account in its effects, this is, apparently, the working hypothesis of many men in the civilized society of to-day. But the magnitude of the latter part and its inexorable relations to man seem to have led him speedily to the adoption of a second hypothesis, namely, that the latter part, or world external to himself, is also the abode of sentient beings, some of a lower and some of a higher order than man, their role tending on the whole to make his sojourn on this planet tolerable and his exit from it creditable, while yet wielding at times a more or less despotic influence over him.

How the details of these hypotheses have been worked out is a matter of something like history for a few nationalities, and is a matter absorbing the attention of anthropologists,

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archeologists and ethnologists as it concerns races in general. Without going far afield in these profoundly interesting and instructive details, it may suffice for the present purposes to cite two facts which seem to furnish the key to a substantially correct interpretation of subsequent developments.

The first of these is that the early dualistic and antithetical visualization of the problem in question has persisted with wonderful tenacity down to the present day. The accessible and familiar was set over against the inaccessible and unfamiliar; or what we now call the natural, though intimately related to, was more or less opposed to the supernatural, the latter being, in fact, under the uncertain sway of, and the former subject to the arbitrary jurisdiction of, good and evil spirits.

The second fact is that man thus early devised for the investigation of this problem three distinct methods, which have likewise persisted with equal tenacity, though with varying fortunes, down to the present day. The first of these is what is known as the a priori method. It reasons from subjective postulates to objective results. It requires, in its purity, neither observation nor experiment on the external world. It often goes so far, indeed, as to adopt conclusions and leave the assignment of the reasons for them to a subsequent study. The second is known as the historico-critical method. It depends, in its purity, on tradition, history, direct human testimony and verbal congruity. It does not require an appeal to Nature except as manifested in man. It limits observation and experiment to human affairs. The third is the method of science. It begins, in its elements, with observation and experiment. Its early applications were limited mostly to material things. In its subsequent expansion it has gained a footing in nearly every field of thought. Its prime characteristic is the insistence on objective verification of its results.

All these methods have been used more or less by all thinking men. But for the purposes of ready classification it may be said that the first has been used chiefly by dogmatists, including especially the founders and advocates of all fixed creeds from the atheistic and the pantheistic to the theistic and the human-

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istic; the second has been used chiefly by humanists, including historians, publicists, jurists and men of letters; and the third has been used chiefly by scientists, including astronomers, mathematicians, physicists, naturalists, and more recently the group of investigators falling under the comprehensive head of anthropologists. The first and third methods are frequently found to be mutually antithetical, if not mutually exclusive. The second occupies middle ground. Together they are here set down in the order of their apparent early development and in the order of their popularly esteemed importance during all historic time previous to, if not including, this first year of the twentieth century.

No summary view of the progress of science, it seems to me, can be made intelligible except by a clear realization of these two facts, which may be briefly referred to as man's conception of the universe and his means of investigating it. What, then, in the light of these facts, has been the sequel? The full answer to this question is an old and a long story, now a matter of minute and exhaustive history as regards the past twenty centuries. I have no desire to recall the dramatic events involved in the rise of science from the Alexandrian epoch to the present day. All these events are trite enough to men of science. A mere reference to them is a sufficient suggestion of the existence of a family skeleton. But, setting aside the human element as much as possible, it may not be out of place or time to state what general conclusions appear to stand out plainly in that sequal. These are our tangible heritage and upon them we should fix our attention.

In the first place, the progress of science has been steadily opposed to, and as steadily opposed by, the adherents of man's primitive concepts of the universe. The domain of the natural has constantly widened and the domain of the supernatural has constantly narrowed. So far, at any rate, as evil spirits are concerned, they have been completely cast out from the realm of science. The arch fiend and the lesser princes of darkness are no longer useful even as an hypothesis. We have reached—if I may again use the cautious language of diplomacy—a satisfactory modus vivendi if we have not attained permanent

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peace in all our foreign relations. Enlightened man has come to see that his highest duty is to cooperate with Nature, that he may expect to get on very well if he heeds her advice, and that he may expect to fare very ill if he disregards it.

Secondly, it appears to have been demonstrated that neither the a priori method of the dogmatists nor the historico-critical method of the humanists is alone adequate for the attainment of definite knowledge of either the internal or the external world, or of their relations to one another. In fact, it has been shown over and over again that man cannot trust his unaided senses even in the investigation of the simplest and most obvious material phenomena. There is an ever-present need of a correction for personal equation. Left to himself, the a priori reasoner weaves from the tangled skein of thought webs so well tied by logical knots that there is no escape for the imprisoned mind except by resort to the weapon applied to cobwebs. And in the serenity of his repose behind the fortress of 'liberal culture,' the reactionary humanist will prepare apologies for errors and patch up compromises between traditional beliefs and sound learning with such consummate literary skill that even 'the good demon of doubt' is almost persuaded that if knowledge did not come to an end long ago it will soon reach its limit. In short, we have learned, or ought to have learned, from ample experience, that in the search for definite, verifiable knowledge we should beware of the investigator whose equipment consists of a bundle of traditions and dogmas along with formal logic and a facile pen; for we may be sure that he will be more deeply concerned with the question of the safety than with the question of the soundness of scientific doctrines.

Thirdly, it has been demonstrated equally clearly, and far more cogently, that the sort of knowledge we call scientific, knowledge which has in it the characteristics of immanence and permanence, is founded on observation and experiment. The rise and growth of every science illustrate this fact. Even pure mathematics, commonly held to be the a priori science par excellence, and sometimes called 'the science of necessary conclusions,' is no exception to the rule. Those who woul

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found mathematics on a higher plane have apparently forgotten to consider the contents of the mathematician's waste-basket. The slow and painful steps by which astronomy has grown out of astrology and chemistry out of alchemy; and the faltering, tedious, and generally hotly contested, advances of geology and biology have been made secure only by the remorseless disregard which observational and experimental evidence has shown for the foregone conclusions of the dogmatists and the literary opinions of the humanists. Thus it has been proved by the rough logic of facts and events that the rude processes of 'trial and error,' processes which many philosophers and some men of science still affect to despise, are the most effective means yet devised by man for the discovery of truth and for the eradication of error.

These facts are so well known to most of you, so much a matter of ingrained experience, that the categorical mention of them here may seem like a rehearsal of truisms. But it is one of the paradoxes of human development that errors which have been completely dislodged from the minds of the few may still linger persistently in the minds of the many, and that the misleading hypotheses and the dead theories of one age may be resuscitated again and again in succeeding ages. Thus, to cite one of the simplest examples, it doubtless appeared clear to the Alexandrian school of scientists that the flat, four-cornered earth of contemporary myths would speedily give way to the revelations of geometry and astronomy. How inadequate such revelations proved to be at that time is one of the most startling disclosures in all history. The 'Divine School of Alexandria' passed into oblivion. The myth of a flat and four-cornered earth was crystallized into a dogma strong enough to bear the burden of men's souls by Cosmas Indicopleustes in the sixth century; it was supported with still more invincible arguments by Martin Luther in the sixteenth century; and it was revived and maintained with not less truly admirable logic, as such, by John Hampden and John Jasper in the last decades of the nineteenth century. To cite examples from contemporary history showing how difficult it is for the human mind to get above its primitive conceptions,

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one needs only to refer to the daily press. During the past two months, in fact, the newspapers have related how multitudes of men, women and children, many of them suffering from loathsome if not contagious diseases, have visited a veritable middle-age shrine in the city of New York, strong in the hoary superstition that kissing an alleged relic of St. Anne would remove their afflictions. During the same interval a railway circular has been distributed explaining how tourists may witness the Moki snake-dance, that wierd ceremony by which the Pueblo Indian seeks to secure rain in his desert; and a similar public, and officially approved, ceremony has been observed in the heat-stricken State of Missouri.

Such epochs and episodes of regression as these must be taken into account in making up an estimate of scientific progress. They show us that the slow movement upward in the evolution of man which gives an algebraic sum of a few steps forward per century is not inconsistent with many steps backward. Or, to state the case in another way, the rate of scientific advance is to be measured not so much by the positions gained and held by individuals, as by the positions attained and realized by the masses, of our race. The average position of civilized man now is probably below the mean of the positions attained by the naturalist Huxley and the statesman Gladstone, or below the mean of the positions attained by the physicist von Helmholtz and His Holiness the Pope. When measured in this manner, the rate of progress in the past twenty centuries is not altogether flattering or encouraging to us, especially in view of the possibility that some of the more recently developed sciences may suffer relapses similar to those which so long eclipsed geography and astronomy.

It must be confessed, therefore, when we look backward over the events of the past two thousand years, and when we consider the scientific contents of the mind of the average denizen of this planet, that it is not wholly rational to entertain millennial anticipations of progress in the immediate future. The fact that some of the prime discoveries of science have so recently appeared to many earnest thinkers to threaten the very foundations of society is one which should not be overlooked

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in these confident times of prosperity. And the equally important fact that entire innocence with respect to the elements of science and dense ignorance with respect to its methods, have not been hitherto incompatible with justly esteemed eminence in the divine, the statesman, the jurist and the man of letters, is one which should be reckoned with in making up any forecast. It may be seriously doubted, indeed, whether the progress of the individual is not essentially limited by the progress of the race.

But this obverse and darker side of the picture which confronts us from the past has its reverse and brighter side; and I am constrained to believe that the present status of science and the general enlightenment of humanity justify ardent hopefulness if not sanguine optimism with respect to the future of scientific achievement. The reasons for this hopefulness are numerous, some of them arising out of the commercial and political conditions of the world, and others arising out of the conditions of science itself.

Perhaps the most important of all these reasons is found in the general enlargement of ideas which has come, and is coming, with the extension of trade and commerce to the uttermost parts of the earth. We are no longer citizens of this or that country, simply. Whether we wish it or not we are citizens of the world, with increased opportunities and with increased duties. We may not approve—few men of science would approve, I think—that sort of 'expansion' which works 'benevolent assimilation' of inferior races by means of a bible in one hand and a gun in the other; but nothing can help so much, it seems to me, to remove the stumbling blocks in the way of the progress of science as actual contact with the manners, the customs, the relations and the resulting questions for thought, now thrust upon all civilized nations by the events of the day. That sort of competition which is the life of trade, that sort of rivalry which is the stimulus to national effort, and that sort of cooperation which is essential for mutual protection, all make for the cosmopolitan dissemination of scientific truth and for the appreciation of scientific investigation. I would not disparage the elevated aspirations and the noble efforts of the

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evangelists and the humanists who seek to raise the lower to the plane of the higher elements of our race; but it is now plain as a matter of fact, however repulsive it may seem to some of our inherited opinions, that the railway, the steamship, the telegraph and the daily press will do more to illuminate the dark places of the earth than all the apostles of creeds and all the messengers of the gospel of 'sweetness and light.'

A question of profound significance growing out of the extension of commercial relations in our time is what may be called the question of international health. An outbreak of cholera in Hamburg, the prevalence of yellow fever in Havana, or an epidemic of bubonic plague in India is no longer a matter of local import, as nations with which we are well acquainted have learned recently in an expensive manner. The management of this great international question calls for the application of the most advanced scientific knowledge and for the most intricate scientific investigation. Large sums of money must be devoted to this work, and many heroic lives will be lost, doubtless, in its execution; but it is now evident, as a mere matter of international political economy, that the cost of sound sanitation will be trifling in comparison with the cost of no sanitation, while further careful study of the natural history of diseases promises practical immunity from many of them at no distant day. International associations of all kinds must aid greatly also in the promotion of progress. Many such organizations have, indeed, already undertaken scientific projects with the highest success. Comparison and criticism of methods and results not only lead rapidly and effectively to improvements and advances, but they lead also to a whole-theologians and publicists as to the stability of the social of men of science on a plane far above the level of the amenities of merely diplomatic life.

When we turn to the general status of science itself, there is seen to be equal justification for hopefulness founded on an abundance of favorable conditions. The methods of science may be said to have gained a footing of respectability in almost every department of thought, where, a half-century ago, or even twenty years ago, their entry was either

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barred out or stoutly opposed. The 'Conflict between Religion and Science'—more precisely called the conflict between theology and science—which disturbed so many eminent though timid minds, including not a few men of science, a quarter of a century ago, has now been transferred almost wholly to the field of the theological contestants; and science may safely leave them to determine the issue, since it is evidently coming by means of scientific methods. The grave fears entertained a few decades ago by distinguished hearted recognition of good work which puts the fraternalism fabric under the stress put upon it by the rising tide of scientific ideas, have not been realized. And on the other hand, the grave doubts entertained by distinguished men of science a few decades ago as to the permeability and ready response of modern society to that influx of new ideas, have likewise not been realized. It is true that we still sometimes read of theological tests being applied to teachers of biology, and hear, occasionally, of an earnest search for a good Methodist or a good Presbyterian mathematician; but such cases may be left for settlement out of court by means of the arbitration of our sense of humor. It seems not unlikely, also, that there may persist, for a long time to come, a more or less guerilla 'warfare of science' with our friends the dogmatists and the humanists. Some consider this conflict to be, in the nature of things, irrepressible. But I think we may hope, if we may not confidently expect, that the collisions of the future will occur more manifestly than they have in the past in accordance with the law of the conservation of energy; so that the heat evolved may reappear as potential energy in the warmth of a kindly reasonableness on both sides, rather than suffer degradation to the level of cosmic frigidity.

Great questions, also, of education, of economic, industrial and social conditions, and of legal and political relations are now demanding all the light which science can bring to bear upon them. Though tardily perceived, it is now admitted, generally, that science must not only participate in the development of these questions but that it alone can point the way to the solutions of many of them. But there is no halting ground

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here. Science must likewise enter and explore the domain of manners and morals; and these, though already largely modified unconsciously, must now be modified consciously to a still greater extent by the advance of science. Only within quite recent times have we come to realize an approximation to the real meaning of the trite saying that the proper study of man is man. So long as the most favored individuals of his race, in accordance with the hypothesis of the first centuries, looked upon him as a fallen, if not a doomed, resident of an abandoned reservation, there could be roused little enthusiasm with respect to his present condition; all thought was concentrated on his future prospects. How incomparibly different does he appear to the anthropologist and the psychologist at the beginning of the twentieth century! In the light of evolution he is seen to be a part of, and not apart from, the rest of the universe. The transcendent interest of this later view of man lies in the fact that he can not only investigate the other parts of the universe, but that he can, by means of the same methods, investigate himself.

I would be the last to look upon science as furnishing a speedy or a complete panacea for the sins and sorrows of mankind; the destiny of our race is entangled in a cosmic process whose working is thus far only dimly outlined to us; but it is nevertheless clear that there are available to us immense opportunities for the betterment of man's estate. For example, to mention only one of the lines along which improvement is plainly practicable, what is to hinder an indefinite mitigation, if not a definite extinction, of the ravages of such dread diseases as consumption and typhoid fever? Or what, we may ask, is to hinder the application to New York, Philadelphia, and Chicago of as effective health regulations as those now applied to Havana? Nothing, apparently, except vested interests and general apathy. We read, not many years ago, that a city of about one million inhabitants had, during one year, more than six thousand cases of typhoid fever. The cost to the city of a single case may be estimated as not less, on the average, than one thousand dollars, making an aggregate cost to that city, for one year, of more than six millions of dollars. Such a waste

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of financial resources ought to appeal to vested interests and general apathy even if they cannot be moved by any higher motives. Thanks to the penetration of the enlightenment of our times, distinct advances have already been made in the line of effective domestic and public sanitation; but the good work accomplished is infinitesimal in comparison with that which can be, and ought to be, done. It is along this and along allied lines of social and industrial economy that we should look, I think, for the alleviation of the miseries of mankind. No amount of contemplation of the beatitudes, human or divine, will prevent men from drinking contaminated water or milk; and no fear of future punishments, which may be in the meantime atoned for, will much deter men from wasting their substance in riotous living. The moral certainty of speedy and inexorable earthly annihilation is alone adequate to bring man into conformity with the cosmic rules and regulations of the drama of life.

And finally we must reckon among the most important of the conditions favorable to the progress of science, the unexampled activity in our times of the scientific spirit as manifested in the work of all kinds of organizations, from the semi-religious Chautauquan assemblies up to those technical societies whose programs are Greek to all the world beside. Literature, linguistics, history, economics, law and theology are now permeated by the scientific spirit if not animated by the scientific method. Curiously enough, also, the terminology, the figures of speech and the points of view of science are now quite common in realms of thought hitherto held somewhat scornfully above the plane of materialistic phenomena. Tyndall's Belfast address, which, twenty-seven years ago, was generally anathematized, is now quoted with approval by some of the successors of those who bitterly denounced him and all his kind. Thus the mere lapse of time is working great changes and smoothing out grave differences of opinion in favor of the progress of science in all the neighboring provinces with which we have been able hitherto to maintain only rather strained diplomatic relations.

Still more immediately important to us are the evidences of

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progress manifested in recent years by this Association and by its affiliated societies. Our parent organization, though a half century old, is still young as regards the extent in time of the functions it has undertaken to perform. It has accomplished a great work; but in the vigor and enthusiasm of its youth a far greater work is easily attainable. Exactly how these functions are to be developed, no man can foresee. We may learn, however, in this, as in other lines of research, by methods with which we are well acquainted, namely, by the methods of carefully planned and patiently executed observation and experiment. The field for energetic and painstaking effort is wider and more attractive than ever before. Science is now truly cosmopolitan; it can be limited by no close corporations; and no domain of scientific investigation can be advantageously fenced off, either in time or in space, from the rest. While every active worker of this or of any affiliated society is, in a sense, a specialist, there are occasions when he should unite with his colleagues for the promotion of the interests of science as a whole. The results of the specialists need to be popularized and to be disseminated among the people at large. The advance of knowledge, to be effective with the masses of our race, must be sustained on its merits by a popular verdict. To bring the diverse scientific activities of the American Continent into harmony for common needs; to secure cooperation for common purposes; and to disseminate the results of scientific investigation among our fellow-men, are not less, but rather much more, than in the past, the privilege and the duty of The American Association for the Advancement of Science.

Viewed, then, in its broader aspects, the progress of science is involved in the general progress of our race; and those who are interested in promoting the former should be equally earnest in securing the latter. However much we may be absorbed in the details of our specialties, when we stop to think of science in its entirety, we are led, in the last analysis, back to the problem of problems—the meaning of the universe. All men 'gifted with the sad endowment of a contemplative mind' must recur again and again to this riddle of the centuries.

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We are, so to speak, whatever our prepossessions, all sailing in the same boat on an unknown sea for a destination at best not fully determined Some there are who have, or think they have, the Pole Star always in sight. Others, though less confident of their bearings, are willing to assume nothing short of second place in the conduct of the ship. Others, still less confident of their bearings, are disposed to depend chiefly on their knowledge of the compass and on their skill in dead reckoning. We of the last class may not impugn the motives or doubt the sincerity of the first two classes. We should find it difficult, probably, to dispense with their company in so long a journey after becoming so well acquainted with them; for among them we may each recall not a few of those rarer individuals of the genus homo called angels on earth. But it must be said in all truth, to resume the figure, that they have neither improved much the means of transportation nor perfected much the art of navigation. They have been sufficiently occupied, perhaps, in allaying the fears of the timid and in restraining the follies of the mutinous. Other types of mind and other modes of thought than theirs have been essential to work out the improvements which separate the earlier from the later nautical equipments of men; such improvements, for example, as mark the distinction between the dug-out of our lately acknowledged relatives, the Moros and the Tagalogs, and the Atlantic liner of to-day.

At any rate, we are confronted by the fact that man's conceptions of the universe have undergone slow but certain enlargement. His early anthropocentric and anthropomorphic views have been replaced, in so far as he has attained measurable advancement, by views that will bear the tests of astronomy and anthropology. He has learned, slowly and painfully, after repeated failures and many steps backward, to distinguish, in some regions of thought, the real and the permanent from the fanciful and fleeting phenomena of which he forms a part. His pursuit of knowledge, in so far as it has led him to certainty, has been chiefly a discipline of disillusionment. He has arrived at the truth not so much by the genius of direct discovery as by the laborious process of the elimination of error. Hence he

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who has learned wisdom from experience must look out on the problem of the universe at the beginning of the twentieth century, with far less confidence in his ability to speedily solve it and with far less exaggerated notions of his own importance in the grand aggregate of Nature, than man entertained at the beginning of our era. But no devotee to science finds humiliation in this departure from the primitive concepts of humanity. On the contrary, he has learned that this apparent humiliation is the real source of enlightenment and encouragement; for notwithstanding the relative minuteness of the speck of cosmic dust on which we reside, and notwithstanding the relative incompetency of the mind to discover our exact relations to the rest of the universe, it has yet been possible to measure that minuteness and to determine that incompetency. These, in brief, are the elements of positive knowledge at which we have arrived through the long course of unconscious, or only half-conscious, experience of mankind. All lines of investigation converge towards or diverge from these elements. It is along such lines that progress has been attained in the past,and it is along the same lines that we may expect progress to proceed in the future.

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ADDRESS

BY

JOHN H. LONG,

VICE-PRESIDENT, AND CHAIRMAN OF SECTION C.

SOME POINTS IN THE EARLY HISTORY AND PRESENT CONDITION OF THE TEACHING OF CHEMISTRY IN THE MEDICAL SCHOOLS OF THE UNITED STATES.

In the scientific awakening of the latter part of the eighteenth century medicine was not the last of the great departments of human learning to take on new vigor. As in earlier years it drew largely from alchemical philosophy for the enrichment of its materia medica, and for the justification of a crude therapy, so now the great teachers of physic stood ready to accept the rapidly developing facts and generalizations of the new chemistry, and to apply them in the noble task of elevating a dogmatic empiricism to the plane of a scientific system. From the time of Paracelsus, alchemy, and its offspring, chemistry, had been but the handmaids of medicine, and much of the skill of the workers in these fields was devoted to the preparation of remedies for various diseases. But, from the labors of Priestley, Scheele, Watt, Cavendish and Lavoisier, the relations were reversed, and the chemists and the apothecaries, the cooks in the kitchen of the doctor, seemed ready to usurp the proud positions of their former masters. The nature of oxidation and the phenomena of respiration changes explained, it was clear that medicine must now depend largely on the development of chemistry for its rational groundwork.

After the downfall of the old iatro-chemistry with its empiri-

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cism and evident hollowness, our science had fallen into disrepute in the great European centers of medical learning, and physicians were somewhat slow in taking up the new ideas. But, the way once opened, the development spread rapidly, almost too rapidly in fact, because of the danger always attending hasty generalization.

The educational influences at work in the American colonies in those days were almost wholly English, and the earliest medical schools established here were modeled after those of Great Britain. We find, therefore, that in each one of the medical schools founded in the pioneer days of attempt in professional education a chair of chemistry was provided for as furnishing a necessary part of the medical student's education. Indeed, the first chair of chemistry of any kind to be filled in this country was that in the medical school of the University of Pennsylvania, and the occupant was Dr. Benjamin Rush, a man justly famous in the early history of American medicine, but not known on account of any chemical writings. This was in 1769, and the position was held by him until 1789. In the autumn of that year Dr. Rush was transferred to another department, and Dr. James Hutchinson was elected to fill the place. The latter died in 1793, and Dr. John Carson was appointed his successor in January, 1794, but died without serving. In this year Priestley came to America, and lived for a short time in Philadelphia. He was offered the chair, but after some delay declined it on account of poor health and the desire to lead a quiet life in a rural country, which he found later on the banks of the Susquehanna at Northumberland.

In July, 1795, the place was again filled by Dr. James Woodhouse, who served until 1809. His successor was John Redman Coxe, who was among the earliest writers on chemistry in this country, since he published in 1811 a small work entitled, 'Observations on Combustion and Acidification; with a theory of these Processes founded on the Conjunction of the Phlogistic and Antiphlogistic Doctrines.' Dr. Coxe was followed in 1818, by Robert Hare, who was a man of great ability and a credit to the new country. Hare made numerous discoveries himself,

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some of them of permanent importance, and besides rendered a service to students by bringing out an American edition of Henry's chemistry. Some years later he published a text-book on chemistry himself for the use of the medical students of the University of Pennsylvania. As Hare's position was unquestionably the most important one of the kind in the country, it may be well to give a few moments' attention to his work as typical of the best of the period.

Hare began his career at a time which, from one point of view, might be considered as very unfavorable for the development of chemistry in America. The early aspirations of the founders of the Philadelphia College had failed of realization because, as must be recognized, they were beyond the practical sympathies or comprehension of the masses. The requirements for the attainment of the degree of Doctor of Physic were relatively, and in some respects, perhaps, absolutely, far in advance of those of the present time, and this the colonies were not ready for. Then came the Revolution, followed by a long period of political discussion and rapid internal development, and finally another bloody war. This left the country poor and yet farther behind again in the sphere of intellectual development. The great European wars of the same period had not hindered scientific discovery or cultivation in France and England, at least. Through these years of turmoil, the beginning which had been made in the few American centers where chemistry was taught had come almost to a standstill, and Hare entered upon what might appear a field of little promise. But the man was an independent thinker, and the example of Berthollet, Dalton, Davy, Berzelius, Gay-Lussac, Humboldt and others was not lost on him. He began his work as a private student and partly in conjunction with the elder Silliman, who came to him before beginning at Yale, and while yet a young man attracted considerable attention by the discovery of the oxyhydrogen blowpipe, a description of which was published in 1802. Later he constructed a new form of galvanic cell with very large plates which was known as the calorimotor or deflagrator, and this gave him no small reputation abroad as well as at home.

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Hare's theoretical explanations of phenomena observed were not always correct, and in some of the many polemics in which he took part he certainly defended the weaker side of the argument, but in looking through his writings one cannot but be impressed with the ingenuity he displayed in contriving experiments to illustrate simple principles.

One of the best known works of chemistry of this time was that of Dr. Henry, of Manchester. The last American edition of this was brought out by Hare, and was used in his own classes and elsewhere in the United States. Later he brought out a book of his own with the title, 'A Compendium of the Course of Chemical Instruction in the Medical Department of the University of Pennsylvania, by Robert Hare, M.D. For the use of his Pupils.' There were four editions of this. The last appeared in 1840-43. In the preface of this book I find this curious passage, which reads as if it might have been written yesterday: "A chemical class in a medical school usually consists of individuals who differ widely with respect to their taste for chemistry, and in opinion as to the extent to which it may be practicable or expedient for them to learn it," etc.

With this idea of the difficulty of the subject and of the slight inclination on the part of many medical students to master it, Hare prepared a work in simple style containing an unusually large number of experimental illustrations and practical suggestions for the pupil. How successful he was with students it is now impossible to say, but that he impressed himself as a powerful teacher I have been assured by one who remembered him in his later years. He remained with the University until 1847, and died in 1858. He continued actively engaged in scientific work to the time of his death, and contributed numerous articles to the journals. No less than 150 were published in *Silliman's Journal.* That his work was respected abroad as well as at home is shown by the fact that he maintained an active correspondence with Faraday, Liebig and other great men of the day, and that we find frequent reference to his articles in contemporary writers and in the earlier volumes of the *Jahresbericht.*

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While Hare was prominent in Philadelphia, Silliman, Gorham and Mitchill were developing the departments of medical chemistry in Yale, Harvard Medical School and Columbia. In the last two medical schools chemistry was taught almost as early as in Philadelphia, but apparently with less vigor, while at Yale it was taken up later.

In 1802 Benjamin Silliman, then a young man, was appointed to the chair of chemistry at Yale, and before beginning work he visited other schools in search of ideas. Prior to 1800 there seems to have been but a single chair of chemistry in the country outside of the medical schools, and this was held by Dr. John MacLean at Princeton. Silliman went there first and profited by what he saw. Later he went to Philadelphia, where he met Woodhouse, Priestley, Hare and others. Hare seems to have made the greatest impression on him, and they worked often together. In the next few years Silliman visited Europe, and on his return to New Haven aroused much enthusiasm among the scientific and medical men. It was largely through his influence that a medical school was established at Yale, and of this he became the first professor of chemistry and pharmacy. The Medical Institution of Yale College, as it was called, was chartered October, 1810, and four professorships were provided for, 'the first of chemistry and pharmacy; the second of the theory and practice of medicine; the third of anatomy, surgery and midwifery; the fourth of materia medica and botany.' It will be noticed that the chair of chemistry is here mentioned first, doubtless a tribute to Silliman's reputation and influence. He continued to give instruction to medical as well as to general students for many years, and through his writings and the journal he established, he became the best known scientific man of the day in America. Silliman's interests, however, were in lines remote from medicine, and he therefore failed to exert here the influence enjoyed by his friend Hare.

The Medical School of Harvard College was established in 1782, and in 1783 Dr. Aaron Dexter was made the professor of chemistry and materia medica, his time being devoted to teaching general and medical chemistry. It does not appear

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that he published any researches or did much to advance his science, but he was a man of personal popularity, and it was through his influence that the Erving professorship was founded by Major Erving, who was one of his patients. Dexter served until 1816 and was followed by Dr. John Gorham, a man of marked ability, who published a number of researches showing skill and understanding, and who must be given credit for bringing out the first original book on chemistry published in this country. The two large volumes compare very favorably with the work of his European contemporaries. Gorham was recognized as a power in the medical school, now moved to Boston, and his reputation was of the first order among his colleagues. He laid the foundation for the excellence in a department which has steadily grown in importance to the present time. Gorham was followed by Dr. John White Webster in 1827, an alumnus of Harvard, and a man of promise who increased the reputation of the university, and especially of the medical school by his original scientific contributions and by editing several well-known foreign works. His text-book on chemistry on the plan of the work of Brandes has considerable merit. The fate of Webster in connection with the Webster-Parkman tragedy of 1850 is probably known to all here.

In New York the old King's College had become Columbia College, and in 1792 established its first professorship of chemistry. This was in the medical school, and Dr. Samuel Latham Mitchill was given the chair. It was this man who introduced the Lavoisier nomenclature in the United States, and in consequence was engaged in many controversies with Priestley. In 1798 he established the *New York Medical Repository*, and managed it for many years. It was the first medical journal started in this country, and exerted no little influence, receiving contributions in general science as well as in medicine.

In 1807 a charter was granted to the College of Physicians and Surgeons in New York, and in 1811 Dr. William James Macnevin was made professor of chemistry. He was a man of marked ability, having taken the medical degree at the age of twenty in Vienna. Several scientific contributions from his

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pen are found in the journals of the time, and among other things he wrote 'An Exposition of the Atomic Theory,' which attracted much attention.

It will not be necessary to trace the history of chemical teaching in the other early medical institutions, as practically nothing of consequence is found recorded. The schools referred to were far in advance of those established elsewhere, and have in a large measure maintained their superiority to the present time.

For many years chemistry was taught to medical students by lectures only, and the introduction of even simple laboratory work is of comparatively recent date. In Harvard Medical School, for example, laboratory courses were not given until 1872.

It would be a discouraging task to try to follow the development of chemical teaching in medical colleges down to the present time. Few institutions were blessed with such men as Hare, Silliman or Gorham, who exerted an influence of priceless value on medical men now rapidly passing away. Owing to peculiar causes which I need not try to explain here, medical schools multiplied very rapidly in the United States, and in most of them the chair of chemistry was considered in the light of a necessary evil. As a matter of form chemistry had to be taught but how it was taught and how it was followed by the students, were questions of wholly secondary importance. It has long been the custom in the medical schools of this country to divide the chairs into the theoretical and the practical. The American boy has been taught to hold practical things in the highest esteem, and chemistry was not practical. Professors and students alike felt it, and it is hard to tell who was the most to blame for the warped and stunted conception of chemistry held even at the present time by the great majority of medical men of this country. It is likely that much of the fault lay in the weak and wholly unsatisfactory manner in which chemistry was presented for fifty years in most of our medical schools. The professor of chemistry was usually a physician who, as a rule, was not considered sufficiently strong to fill the chair of practice, obstetrics, or surgery, but who might teach acceptably the less important branch of chemistry.

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For the convenience of such teachers a peculiar system of chemistry called 'medical chemistry' was developed, and in some places persists to the present time. The idea that a man trained outside of a medical school could teach the kind of chemistry which medical students really needed was of slow development in the United States, and in some quarters fails yet of recognition. But for part of the trouble we must go farther back. While students in general courses were taught the elements of the sciences, languages and mathematics by recitations and quizzes, medical students, with far weaker preliminary training, were supposed to be able to absorb the essential facts of a great department of human knowledge from lectures alone. The lecture system is responsible for much of the superficiality in the old-fashioned medical schools, and no real progress was made until it began to be recognized that a medical student must be taught as other students are. With the gradual dawn of this notion it became finally possible to introduce into medical colleges rational chemical instruction, and the laughable farce of presenting the so-called medical chemistry to students ignorant of general chemistry will in time be a thing of the past.

This medical chemistry to which I call your attention was often a curious combination of the good and the absurd. Admitting that the student should know something about the chemistry of the blood, the bile and the urine, something about the nature of foodstuffs and the processes of digestion, it was thought sufficient to present all these matters to him in condensed, so-called 'practical' form, and without first requiring a solid preliminary training in general and inorganic chemistry. It was considered the correct thing to memorize a lot of definitions, and to learn to recite in parrot fashion a number of empirical organic formulas. It must be admitted, however, that the fault was not confined to medical schools alone.

Chemistry in general may be studied from two standpoints. First, as in the college of liberal arts, as a fundamental discipline, regardless of the possible application which one may make of it. On the other hand, it may be pursued as a necessary preliminary to the understanding of something else, and

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in this case its mastery becomes all-important. One would naturally suppose that in the latter case the science would be much more thoroughly cultivated than in the former, but this is not always true. The discrepancy is perhaps most glaringly apparent in the chemical work of the medical schools. It cannot be expected of course that the chemistry offered to the medical student of to-day should be, as in the time of Hare, Gorham and the elder Silliman, more complete than that given to other students; this would be impossible and wholly unnecessary, as chemistry is now a great specialty with numerous departments branching in all directions and a literature as voluminous as that of scientific medicine itself. But this much should be reasonably expected, that the medical student's elementary chemistry should be at least as thorough as that of the student in liberal arts. It seems absurd to think that a man preparing, possibly, for law or theology or commerce, or studying without thought of any specialty should be made to acquire a fuller, more accurate knowledge of chemistry than that expected of the future medical man. If chemistry is of value at all, it certainly is to the doctor, rather than to the preacher, lawyer or man of business, yet in the United States in the last fifty years, the doctor's training in chemistry has been, on the average, less exacting than that of the other classes mentioned. If any one is disposed to doubt what I say let him compare the numerous 'Essentials of Chemistry for the Medical Student' with the text-books used in other schools in the same science. It is anomalous that the doctor's chemistry should be usually the weakest of all.

But we are gradually emerging from this discouraging situation, and the improved condition is mainly due to the recognition of this fundamental truth, that there is not one kind of elementary chemistry for the doctor, another for the lawyer and a third for the preacher. There is no royal road to the acquisition of the necessary groundwork, and the medical man's elements must be learned through the same kind of patient effort that is required of other men. In the best of the medical schools of the country to-day chemistry is no longer taught by practitioners of medicine, and an honest effort is being made to

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present the subject as it is presented to beginners in schools of science. Such a course of laboratory and recitation work should require at least ten hours each week through a year of eight months to cover the work preliminary to the proper study of medical or physiological chemistry in the second year.

This leads me to explain what I consider the minimum work in preparatory chemistry for the medical student, and the character of this work. First, he should have the usual lecture or recitation course of about seventy-five lessons in general and inorganic chemistry, with especial attention paid to the theoretical groundwork. A discussion of the common inorganic salts is of less importance. This work should be followed or accompanied by a laboratory course in experiments, including the preparation of a few pure substances. In most of our schools the value of preparation work has not been sufficiently recognized, the time which might be spent there going usually to qualitative analysis which I believe is correspondingly overestimated. Inorganic qualitative analysis for most students becomes a mechanical routine in which the important element of discipline is wanting. As in the future work of the physician this branch of analysis finds little or no application, I believe the time given to it in preparatory medical work may be greatly curtailed. During the past twenty years, in which I have given instruction to medical students, I have had abundant opportunity to observe this fact, that men who have entered with training in experiments and preparations and no qualitative analysis make as a rule far better progress than do those whose laboratory work has been wholly analytical. Many of our colleges still begin their laboratory work with qualitative analysis, which, perhaps, is a relic of concession to the old utilitarian notion, and I am convinced that for the average student the time so spent is largely wasted. On the other hand, volumetric analysis may be made a medium of imparting important knowledge in fundamental principles, and I believe it should find early presentation in all our courses, general as well as medical, that it should precede rather than follow gravimetric analysis as is customary. In the case of the medical student the importance of volumetric analysis is twofold. Not only is it a valuable

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discipline in itself, and discipline is above all what is needed in preparatory medical training, but it also becomes an instrument of practical application in the physician's subsequent work. In his practical routine labor of a clinical nature the physician is constantly called upon to make a few qualitative tests which are soon learned and easily followed. He should be in a position to make a wider range of quantitative tests, and these, almost of necessity, must be volumetric. The preparatory medical course should provide this skill not merely in a mechanical way, but by giving a thoroughly rigorous drill in the few fundamental principles of volumetric analysis. The statement I have just made may provoke a smile, inasmuch as I may appear to be giving advice on a matter which everyone well understands, and suggesting a course which is commonly already everywhere in practice. But it has been my experience that the matter is by no means as simple as it looks. The apparently elementary relations in volumetric analysis are not fully grasped by the general class of students, even by those who devote far more time to laboratory chemistry than is the case with the medical students of our best schools. In support of this I must state that in the last fifteen or twenty years it has been my fortune to instruct hundreds of medical students who had already had laboratory training in chemistry in excellent schools, well-known state universities among the number. While these men have often brought sufficient knowledge of facts, they have as often been very deficient in acquaintance with principles, leaving them unable to deal with cases presenting slight variation in conditions from those of their former practice. Our methods of instruction fail as long as they allow the memorization of facts and isolated methods to take the place of a study of principles. I am often asked what the value of this or that inorganic volumetric process is to the medical student, and my answer is that it illustrates a principle not readily learned in any other way. And it is safe to say that almost any one of these illustrative methods may find practical application in the physician's own work. The titration of weak acids, for example, is now a common operation in connection with the examination of stomach contents, and the permanganate titra-

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tion has come into common use in the most accurate process we have for the estimation of uric acid.

I trust that I have made myself understood in insisting that the groundwork of the medical man's education in chemistry should be in the group of topics usually classed as inorganic, and this largely because of the superior advantages of this branch of the science in the presentation of general principles. I feel, therefore, like combating strongly the notion often expressed by medical men that students in medicine should not be required to 'waste' time on inorganic chemistry.

A few words as to the place of general organic chemistry in the preparatory or first year course. The subject is one of such large proportions that at best only an outline can be attempted in the first year course, but that much should at least be given. Leaving the major portion of the discussion of the sugars and other carbohydrates, the fats and the products of fermentation to be taken up with physiological chemistry proper in the second year, I believe that a fairly satisfactory outline may be given in about thirty lessons in the first year course. Remember, I am not writing this for men who expect to be chemists, and I am describing the minimum requirement which I should insist upon. In a short course of the kind it will be necessary to omit many things often supposed to be of prime importance in the so-called medical chemistry. I have seen text-books for medical students abounding in descriptions of processes for making many of the modern synthetic remedies along with discussions of the supposed structural formulas of these compounds. This knowledge is interesting, but it is far from essential, as few principles are cleared up by it which cannot be presented to the student in more tangible form. It should be further remembered that there is a distinction between chemistry and materia medica, and much matter presented to students as chemistry properly belongs in the other field. The time spent in memorizing the empirical formulas of the medicinal alkaloids and of the host of antipyretics, hypnotics, etc., might better be given to a study of principles. Of course, I would not be understood as urging that the medical student need not be taught the constitution of any organic compounds, but I merely claim that there is a

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limit to the amount of this knowledge which may be considered practical or profitable.

I have spoken of the work just described as first year medical work, as it may be taken before entering the medical school or in the first year of the course in medicine. The time is not far distant when all the courses I have described, and doubtless more, will be required for admission to the best schools. At present Harvard Medical School has such a requirement, and other institutions have it under consideration. Many colleges of liberal arts and technical schools offer now a so-called preparatory medical year in which chemistry is the principal topic. Certificates for such a year's work admit to the second year of many of the medical schools of the country. In my experience the plan is not yet a satisfactory one, as the chemistry courses taken under these conditions seem to be lacking in rigor and discipline. They seem to be followed under the notion that medical school chemistry is so completely lacking in thoroughness that anything may be pursued as its equivalent.

In the last few years students have begun to present high school certificates for chemistry work as equivalent to that in the first year of the medical school. The courses taken in the high school at first sight may appear to be more than equivalent to those in the beginning year of the medical course, but a careful consideration of many cases has convinced me that in general it would be very unwise to grant credit in the medical school for work apparently done in the high school in chemistry. At the age at which boys and girls now do their chemistry work in most of the high schools it is quite impossible that the subject can be properly mastered. In my opinion the superficial courses now given in science in hundreds, perhaps thousands, of high schools throughout the country constitute one of the weakest spots in our system of public education. The attempt is often made to cram more chemistry into the high school boy at sixteen than many of our smaller colleges find possible at twenty. In much of this work the glorification of the teacher, not the true edification of the pupil, seems to be the prime object in mind, and the result is deplorable. With these facts in view, I always feel justified in rejecting the appli-

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cation of the student for advanced standing on account of high school work in chemistry. I am therefore inclined to the opinion that under existing conditions the medical student's work in general and inorganic chemistry can be best done either as a part of a thorough and required college course, or after entering the medical school itself, and that wherever done it should be characterized by a much more systematic and painstaking drill in fundamental principles than seems now to be the case in many institutions.

It is not my intention to enter upon a discussion of what the course in physiological chemistry should be in medical schools. At present this often consists of a laboratory course in urine analysis only, along with a few lectures on subjects belonging to materia medica, pathology or practice rather than to chemistry. In many of the larger and more progressive schools this work is broadened out so as to include experimental studies in the sugars, the fats, the albumins, the processes and products of digestion, and the examination of milk, blood, the gastric juice, bile, etc. There is a great diversity of opinion as to how much of this work may profitably be taught in the medical school. It is my own view that it is all out of place if it is not preceded by the proper drill in general chemistry to enable the student to really understand what he is doing. Without this clear understanding the laboratory course in physiological chemistry, which looks so well on paper, and which fills a good amount of space in the college announcement, degenerates into a mere mechanical routine, and becomes as valueless from the standpoint of discipline as is the justly condemned 'test-tube drill' in qualitative analysis. If the student is so illy prepared for his work that the operation of stirring a heated mixture of alkali solution and fat means simply 'making soap,' he might just as well spend his time in turning a grindstone, as far as intellectual benefit is concerned. Unless he can connect this operation with many similar ones, and with the other processes of splitting fats, the experiment fails of its object. I am firmly of the opinion that the explanation of the low value placed on chemistry by many medical men may be found in the fact that in their own student days they have been forced

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through this kind of a routine course lacking the preliminary knowledge that would enable them to comprehend it. I maintain then that unless the student has been properly and systematically prepared in the elements of organic and inorganic chemistry, much of the matter presented to him in physiology and physiological chemistry must remain practically meaningless. As Professor Remsen well says: "It is difficult to see how, without some such general introductory study, the technical chemist and the student of medicine can comprehend what is usually put before them under the heads of applied organic chemistry and medical chemistry." (Preface to 'Organic Chemistry.') But, on the other hand, supposing that the medical student has been successfuly prepared in an elementary preliminary course such as I outlined above, there is much indeed that he can really master in physiological chemistry proper. It is not necessary that he should be able to make many elaborate quantitative experiments. Most of the really important reactions in the study of the fats, the sugars and the proteids may be mastered with the aid of comparatively simple qualitative and a few volumetric tests. He will be able to demonstrate understandingly the essential facts connected with most of the digestive and other ferment changes, and to follow variations in excretion corresponding to variations in food consumption, or depending on pathological conditions. This carries the medical student as far as he is ordinarily called upon to go. Anything beyond this naturally belongs to the specialist, and besides would consume more time than can be usually spared from the medical course.

From a perusal of many of our text-books on physiology and physiological chemistry, the student is very apt to draw erroneous conclusions as to the nature of some of the reactions in this department of science. For simplicity in didactic presentation the teacher or writer is too apt to show everything in an ideal way. A great many dogmatic assertions are made, for example, concerning the digestion of the starches and the proteids, and the student almost expects to separate and recognize the half dozen or more beautiful products lying between corn starch and malt sugar, or the different hemis and antis, pros

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and paras in the still more complicated proteid family. The teacher who is not himself an investigator is but too ready to become an idealist, and to present all these intricate details in systematic tables and diagrams as he thinks they ought to be, and perhaps are, rather than as the original experimenters have actually been able to find them. The student must be warned against this, and not the least valuable function of the laboratory work in physiological chemistry in my judgment is to show him the inherent difficulties in much of our research work. An honest recognition of limitations will guard him against many future mistakes, against the preposterous analyses, for example, made by many young medical men while serving as hospital internes or in other capacity. I said a moment ago that there is much which may be easily and accurately learned in physiological chemistry by the medical student. It is evident that there is much more which in the ordinary college course cannot be mastered, and against pretended knowledge here the student cannot be too earnestly warned.

Physiological chemistry is in some institutions recognized as a distinct discipline, independent of medicine. This is true of the chair in several of the great European universities, and of at least one of the older American schools. Physiological chemistry is thus presented as is general biology or comparative anatomy. But in the great majority of cases it is looked upon as forming a part of medical rather than of general discipline, and doubtless for years to come the medical school will have many advantages in properly presenting the work. Inasmuch as no small part of the material employed in the laboratory demonstrations in the later parts of the course must be drawn from hospitals and clinics, it would seem that the effort sometimes made by other schools to give the equivalent of the medical school's work in this field must be in part futile. I am forced to the conclusion, from several practical considerations, that the student of medicine should not as a rule attempt to take physiological chemistry as a preliminary study outside the medical college. There is generally something lacking in such courses which the student recognizes often only after it is too late to recover lost ground.

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Occasionally the work in physiological chemistry is given as a part of the course in physiology, but this, I believe, is a mistake, as the study is often curtailed to a consideration of a few physiological problems instead of being treated as an independent science of broad dimensions. With the present rapid expansion of this field of effort, the work calls for the attention of the specialist in chemistry rather than in physiology. This is necessarily true with respect to research study, and it is becoming equally true as regards the matter of proper didactic presentation. Much of the valuable pioneer investigation in physiological chemistry was done by physiologists, but in its later development the chemist alone can be expected to follow the accumulating mass of detail, and to sift out that which is of permanent value. It requires often rare judgment to decide how much of the newer knowledge is suitable for laboratory or class study, for no one wants to burden the already overtaxed student with a load of premature generalizations. While much of the latest work is always interesting to the specialist, it may often be quite unimportant to the student, and where to draw the proper line of separation between the new and the old calls for the teacher's maturest judgment. This same idea should be kept in mind in estimating the value of research work for the average professional student. The training of medical students in the United States is a vastly different thing in theory and in practice both from what it is in Germany, from which land we draw so many of our ideals. We give the title of 'Doctor' to the product of our schools, but in reality we are producing *practitioners* of medicine and in the shortest possible time. The man really learned in medicine should be able to present an original research, as the German idea assumes, but the practitioner may be just as successful in actual contact with disease without this skill. I would not be understood as underestimating the value of high scientific training for medical men. Indeed in certain specialties the medical man's success depends almost wholly on his preeminent scientific knowledge acquired by long and minute study. But there is still room for the general practitioner in medicine, and in my judgment he is, and should still remain, the most useful member of the profes-

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sion. The American medical school is mainly concerned in the training of men of this class rather than of those with more special knowledge, and broad culture is of more importance here than minute acquaintance with bacteriology, physiological chemistry or histology. This is an age in which we are constantly called upon to do something new, regardless of whether the new thing is really needed or not. This criticism applies to research problems in physiological chemistry given to medical students as well as it applies in any other field. It will often be found that the teacher's interests rather than those of the student receive the first consideration, and this is certainly without justification in view of what I have said about the true field of work in American schools.

The teacher who attempts the proper presentation of general and physiological chemistry in a medical school has indeed no easy task. His work is made doubly hard by the fact alluded to above, that chemistry among the older medical men is still looked upon as a comparatively useless study, and from his preceptor's office the embryo doctor often brings this notion to the medical school. To combat this idea honestly, and to put his science before the medical student as it would be presented in a scientific or general course to freshmen or sophomores, requires the full time and energy of any man, and often little room will be left for research investigation, or, what is to some more alluring, the emoluments of commercial or expert work. But the sacrifice, if indeed it may be called such, is worth the effort. There are about 25,000 medical students in the United States, and the number graduated each year is not far from 5,000, in all schools. The number of registered physicians is about 1 to 636 for the whole population. It is no small matter to be able to make the proper impression on the minds of these men, and positions as teachers in the growing medical schools of the country have been perhaps too long overlooked by the better class of chemical graduates in search of academic openings. There is a field here which is worthy of fuller cultivation.

While I have intimated above that the possibilities for research work in chemistry for the average medical student or

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teacher are limited, and necessarily so, I am far from underestimating such work. While it is indeed true that in many quarters a trifling research on some trivial point of wholly artificial interest may be more highly prized than is the most painstaking and successful effort in class-work, and while it is also true that the layman, or professional man of little experience as well, may often be deceived as to the real value of such efforts, it is likewise a fact that there is always a proper appreciation of original investigation in lines of human interest. There is no more inviting field for labor of this kind than is found in the chemistry of life. The greatest problems in the scientific medicine of the future are undoubtedly chemical problems. Indeed there are no more important or inviting problems to be found in any line of study than are here presented, and the investigator will find in them enough to tax the skill and ingenuity of the most learned for years to come. This work naturally and properly belongs to the physiological chemist, and that it must be done before much further advance can be made in scientific medicine is already recognized by leading medical men. The idea was clearly presented by the Dean of the Northwestern University Medical School in the address on Medicine at the recent meeting of the American Medical Association at St. Paul, and we find it brought forward more or less emphatically elsewhere.

The chemical difference between certain of the tissues in health and disease may be very minute in some instances, but in other cases it is certainly more pronounced and capable of demonstration. This problem will unquestionably prove one of the most interesting for future investigators. We have long had considerable acquaintance with the products of renal excretion, somewhat less with the products formed or active in the stomach, and very much less with the complex reactions taking place in the lower stretches of the intestines. Investigation here is probably fully as important as in either of the other cases, but from its inherent difficulties has been but little developed. As the analysis of the urine gives us our most certain data for the diagnosis of diabetes and various renal disorders, so, it may be expected will the rational chemical examination of

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the intestinal excretion prove of equal value in the exact diagnosis of other bodily ailments. There is certainly as close a connection in the one case as in the other. These questions are purely practical, and will some day claim the attention of skilled and accurate analysts.

In the field of theoretical investigations the possibilities are even greater. Almost nothing, for example, is known of the steps in nitrogenous metabolism. Between the ingested albumin and the excreted urea and uric acid is a long distance yet to be traveled by the chemical investigator; a few of the possible resting places on the way are known, but the relations of one to the other are yet extremely obscure.

Scarcely less obscure in its fundamental bearings, although seemingly less intricate, is the question of the nature and mode of action of the soluble ferments or enzymes. This is a problem of chemistry rather than of biology, as the question of the production of these substances is merely an incidental one. The epoch-marking work of Buchner in separating the active enzyme from the cells of yeast has gone far to break down the old and artificial distinction between the soluble and insoluble ferments, and to show that all these so-called vital processes are accomplished through what are essentially chemical means. It has long been supposed that in their mode of action the work of the enzyme is purely analytical, but since the interesting observations of Croft Hill on the formation of maltose from dextrose have been confirmed by O. Emmerling, who found, however, that it was isomaltose that was produced, we have opened up a new line of possible investigation which may throw light on some of the processes taking place within the animal body, where it was assumed by Liebig and others that *syntheses* do not take place.

Lately a fruitful line of investigation has been suggested by Bredig in his work on the 'inorganic ferments,' where he shows that colloidal platinum in its oxidation assisting behavior presents the closest analogy to some of the common organic enzymes. The colloidal metallic solutions seem to be affected by the same kinds of poisons which are known to impede the action of the soluble ferments, and to recover finally in about

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the same way. All these matters become of the greatest interest to the physiological chemist when we recollect that nearly all the body processes are doubtless enzymic in their character, and that the toxines or disease producers are probably chemical agents of the same class.

But it was not my intention to discuss new discoveries in chemistry. I merely wished to emphasize the fact that the fields of physical chemistry and synthetic organic chemistry are not the only ones to claim the serious thought of active investigators. I wished to suggest that the chemistry bearing on the problems of life itself presents no less interesting possibilities, and that it is worthy of more enthusiastic cultivation in our American schools. While it is doubtless true that the elementary practical instruction given in chemistry to American medical students is now equal to or possibly more systematic and thorough than that given in the majority of European schools, I wish to express the hope that in the further development of our medical colleges research work may find fuller recognition, and that in the solution of the great problems hinted at our American scholars may contribute their rightful share of effort, and in the end reap the corresponding measure of reward.

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ADDRESS

BY

JOHN A. BRASHEAR,

VICE-PRESIDENT AND CHAIRMAN OF SECTION D, FOR 1900.

THE CARNEGIE TECHNICAL SCHOOL.

It was the intention of your vice-president to prepare an address on the Evolution of the Mechanics of the Telescope for presentation before Section D of this Association, but a new and important theme has been brought before me by reason of intimate association therewith, and to which a number of the members of this Section have contributed most valuable data. I therefore beg to present to you a few notes upon this subject, namely, the technical school for which Mr. Andrew Carnegie has most generously proposed to furnish the means to build, equip and endow in the city of Pittsburg. When Mr. Carnegie gave to the city its library, its art gallery, its temple of music and its museum, neither the donor nor the citizens had the remotest dream of what they would develop into, nor how far their influence would reach and be felt. I need not tell you what potent factors these institutions have been as educators in the realms of art, science and literature. Suffice it to say, that every department of the great institute has proved itself worthy of its name and is doing marvelous work for the betterment of the people. So marked has been this development during the six years of the existence of the Pittsburg Institute that Mr. Carnegie has given over three million dollars to enlarge its boundaries and increase its influence.

But Mr. Carnegie had promised even greater things for the city of his adoption. He knew as well as any man the need, the great value of a school of technology in Pennsylvania's great hive of industry; and with but little preliminary discus-

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sion of the subject, with full confidence in the commission that had been entrusted with the building, care and development of the Pittsburg Institute, he proposed to furnish the means to build, equip and endow a school of technology on the broadest possible basis, whose doors should be open not only to students from western Pennsylvania, but eventually to students from any part of the world.

President Frew, of the Carnegie Commission, appointed two committees: (A) A committee to confer with the city officials in reference to a site for the building, etc. (B) A committee on 'Plan and Scope' of the proposed technical school. On this latter committee President Frew appointed the following gentlemen:

President Wm. McConway, of the McConway, Torley Manufacturing Co.; Chas. M. Schawb, president Carnegie Steel Co.; Wm. A. McGee, 'Times Publishing Co.; Hon. Wm. A. Diehl, Mayor of Pittsburg, and John A. Brashear.

After a series of important meetings in which the best plan of procedure was carefully discussed, Mr. Schwab found it necessary to resign as a member of the committee, as he had been called to the position of president of the United States Steel Co. The resignation of Mr. Schwab was greatly regretted, as he has had large personal experience in technical and manual training schools, having built and endowed a splendid school in Homestead, Pennsylvania, in the very center of the great steel industries. Mr. W. Lucien Scaife was appointed to fill the place made vacant by the resignation of Mr. Schwab. He is a graduate of the Sheffield Scientific School and has studied in the technical schools of France and Germany, and his technical and practical knowledge has proved of great value in the deliberations of the committee.

After a careful discussion of the plan of procedure it was decided to call to our assistance a number of the best men on technical lines in the country, rather than one man, no matter how thoroughly he might be posted in technical school matters, for the one man might have a bias, either of education or environment, which, while it possibly would be in the direction of the very best plan and scope for the new school, might be

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detrimental to its highest development; and in this important matter it was concluded that in the multitude of counselors' there ought to be wisdom. The committe therefore called to its assistance, Dr. Robert H. Thurston, Professor J. B. Johnson, Dr. Thomas Gray (all members of Section D of the Association) and Dr. Victor Alderson, acting president of the Armour Institute of Chicago. These gentlemen were to come to Pittsburg last spring to study the conditions and environment which would necessarily be important factors in formulating the plan and scope of the new school and, after several pleasant meetings with our own committee, arranged to return to Pittsburg on the 24th of June to make at least a preliminary, if not comprehensive and final report. In the meantime the original committee found much work to do, for communications were coming from eminent technologists, technological societies, domestic art associations, educators in manual training schools and mechanical engineers, all of which contained much good grain, with here and there a hobbyist whose theories were mixed with a good deal of chaff; but on the whole we found a wide-spread interest in the development of what, let us hope, will eventually become one of the best institutions for technical instruction in this good land of ours. It is for the purpose of leading the members of this Section of the American Association to take an interest in the new school, that this paper is written. It contains no new thought, no new theories, but calls for your help in a project which we believe will be for the betterment of a large class of students, whose means are necessarily limited, but who will be, let us profoundly hope, mighty factors in the future development of American technological and allied industries.

If we are to keep fast hold of the prestige we have gained in the industrial world by hard work and persistent effort, we must open the storehouse of knowledge to our future mechanicians, engineers, etc., give them an opportunity to partake of the treasures stored therein, and we shall have no fear of the position we are to occupy in the coming years.

Our advisory committee, having studied the problem from many points of view, met with us in Pittsburg on the twenty-

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fourth of June last, each member having formulated his plans without consultation with other members of the committee, yet it is a matter of interest to know that the expressed views of the advisory board as individual members were so nearly in accord on the general principles formulated for the great school of technology. Of course with such a field to work upon, there were a number of most valuable suggestions made by the individual members of the board, all of which will be of use to our committee in making up its report to the commission.

With your permission, and I am sure with that of the several members of the advisory board, I will give as briefly as possible an outline of the scheme for the new technical school.

First, as to site. The Carnegie Institute is situated in Schenley Park; and it was thought desirable by Mr. Carnegie and members of the commission to secure, if possible, enough ground near the Institute for the technical school. A tract of eleven acres was the only available land in the Park, but this was at once pronounced far too limited in extent for the new school; indeed the first plan of buildings, campus, etc., submitted by Mr. Emil Swensson, of the Carnegie Steel Co., covered 40 acres and this for not more than 1,000 students. The advisory board suggested that not less than 50 acres be secured, and as a tract of 65 acres is available not far distant from the Carnegie Institute, the board strongly recommended its purchase, or a similar piece of land as near by as it is possible to obtain it. A potent reason for placing the technical school near the Carnegie Institute is the fact that its library is rich in technical and other valuable works, which need not be duplicated in the technical school library; indeed the association of the school with the great and increasingly valuable library, museum, art gallery and Academy of Science and Art is certainly to be desired. In this connection it may be well to state that it was the intention of the donor that the city should furnish the land upon which the school of technology should be built, but it is the unanimous opinion of the advisory board that, as Mr. Carnegie proposes not only to build and equip but fully to endow it, it would be far better to purchase the land and thus, while bringing to the city of Pittsburg all the honor

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such a school of technology would bring, keep it forever free from baneful political influences. Dr. Gray says in summing up his report: "Such an institution properly managed, could in my opinion do much more to advance the science which underlies our industries than any national or State institution is ever likely to do, hampered as all of them are by political association. I may in conclusion express the opinion that for the best work, independence of city or other politics should if possible be insured by avoiding all kinds of public financial support."

As to the buildings for the technical school but little has been suggested; indeed, this part of the problem, important as it is, may well be left open until the 'scope' of the great work to be done is well in hand. Dr. Thurston in his report has given an interesting résumé of the space occupied by the student in the various German technical schools, remarking that the German motto 'Viel Platz, Viel Licht, Viel Luft,' would be an excellent guide in determining this question. He says: "Ample space, good light and plenty of fresh air are essential, although the architect who should be the most earnest and intelligent of them all is often wofully deficient in appreciation of their importance when brain work is going on." Dr. Thurston further states that taking figures from the best German technical schools, which are based on the largest experience, the school of architecture at Berlin has 150 feet floor space per student, the engineering school 35 feet, but this latter school is so much overcrowded that arrangements are being made to give the student in this department at least 75 feet of floor space. In marine engineering 111 feet are provided and in metallurgy and the chemical departments each student has 426 square feet of space. Professor Thurston advises not less than 30 square feet per student in class rooms, in drawing rooms about 100 and in laboratories from 150 to 500 feet, according to character of the work to be done and magnitude of the space required for machinery and apparatus.

The Brunswick school has 410 feet floor space per student in all departments. At Karlsruhe 450 square feet are provided in the department of electrotechnics. The cost of the Berlin building is placed at $1,000 per student, of the Brunswick

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buildings $2,000 per student. From this data it can be seen that an institution which may be called upon to provide for a thousand students at once, and perhaps three or four times that number in the near future, must be planned upon a most liberal scale to meet the demands which will be made upon it, and here we shall be confronted with the cost of such buildings. With the knowledge that Mr. Carnegie would not be satisfied with buildings devoid of architectural beauty, I feel morally certain that he would not be willing to invest his millions in buildings not properly constructed for the specific purpose for which they are intended, and with all regard to the society of architects, it is to be hoped that utility will be the first question solved in this important undertaking.

In a recent communication from Dr. Barker, of the University of Pennsylvania, upon this subject he says: "I hope the mistake will not be made of spending too much money upon buildings. The order of expenditure should be as follows: (*a*) Instruction; (*b*) endowment; (*c*) equipment; (*d*) building; by this I mean that the securing of the very best ability in the men in all the departments is an absolute desideratum, not only as teachers but investigators, for technical science is advancing so rapidly that abstract research in pure science can not keep up with it and so applied science has to enter upon research work to supply the data it needs.

"Next comes endowment. In far too many cases, all the money given has been expended upon building and equipment, leaving nothing for maintenance." Dr. Barker then refers to a number of our noted American universities which have splendid buildings and some of them fine equipment, but with little or no funds to carry on research work. The members of this Association know this fact too well, many of them from unpleasant personal experience. Shall we steer clear of these shoals in the new technical schools?

Brainy men do not need a palace in which to make discoveries. Place a Newton, a Napier, a Faraday or an Edison, a Watt or an Ericson in a hovel and the discoveries will come whether we will or not. Fortunately we are assured that the man who has given this great technical school for the glorious

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purpose it is sure to subserve will see to it that the endowment does not suffer, even if the buildings are constructed on a generous scale, but I know it to be his desire that the best technological knowledge shall be united with architectural design, so that the buildings may combine utility with beauty and reflect honor on all associated with the work.

And now as to the scope of the new school. That American schools of technology have done magnificent work for two or three decades goes without saying. Shall the new schools follow in the footsteps of the best of them, shall it unite the best features of one school with the best of another, or shall it venture upon entirely new fields to push outward the borders of human knowledge? The American, German, English, French and Swiss schools have been studied by the members of the advisory board (as well as by some members of our committee), and we have been greatly helped in formulating our plans of what the new school should be, by the generous data given in their report.

A summary of Professor Johnson's proposed scheme for the Carnegie School of Technology is as follows:

A. Colleges. Courses of four years with a high school preparation.

1. College of Science.
2. College of Engineering.
3. College of Commerce.

All the above of university grade, with degrees conferred at graduation.

B. Schools. Courses three years with a grammar school preparation.

1. Manual Training School.
2. Domestic Science School.
3. School of Industrial Design.
4. School of Commerce.

All the above of high school grade. Diplomas given at graduation.

C. Artisan Day School. Courses of three years with a preparation in reading, writing and arithmetic.

To include courses of instruction in subjects of essential importance in the practice of the various trades.

D. Night School for day workers. Preparation same as C.

Regular courses, and also special instructions of practical value to day workers of all sorts and all employments.

Professor Johnson, Dr. Alderson and Dr. Gray studied a

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number of the industries of our city, and in all their reports they emphasized the value of the secondary schools. The question of monotechnic or trade schools, *i. e.*, where a young man or woman can learn at least the rudiments of the trade by which they propose to make their living, was also discussed by Professor Johnson and Dr. Alderson with the writer, and it is the opinion of both committee and advisory board that in due time this part of the problem should be given earnest consideration. A summary of Dr. Alderson's recommendations as to the various departments that could advantageously be established in the school are:

First—Department of Engineering, comprising

(*a*) Mechanical Engineering.
(*b*) Electrical Engineering.
(*c*) Civil Engineering.
(*d*) Chemical Engineering.
(*e*) Electro-chemical Engineering.
(*f*) Foundry Practice.
(*g*) Metallurgy (iron and steel).

Second—Department of Secondary Education.

1. Work preparatory to the College of Engineering.
2. Secondary Technical Education.

Courses in

(*a*) Machine Tool Work.
(*b*) Stationary Engineering.
(*c*) Elementary Electrical Engineering.
(*d*) Elementary Mechanical Engineering.
(*e*) Foundry Practice.
(*f*) Surveying.
(*g*) Drafting.
(*h*) Machine Design.
(*i*) Glass Making.
(*j*) Blacksmithing.
(*k*) Pattern Making.
(*l*) Brass Making.

3. Department of Library Economy.
4. Department of Domestic Arts and Sciences.

(*a*) Normal Course.
(*b*) Courses in cooking, sewing, dressmaking, millinery and household economy.

5 Department of Art.
6. Department of Evening Instruction.

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Dr. Alderson closes his summary with these words of sterling advice: "The Carnegie School of Technology should be a protest against *surface education;* it should educate the hand and eye as well as the mind; it should emphasize the *doing* element in education; it should be essentially a school of applied sciences; and finally it should enter the broad field of technical education, supplying useful knowledge to boys and girls, young men and young women. The Carnegie School of Technology, located in a center of industrial activity, on grounds naturally beautiful and attractive, carefully planned and thoughtfully administered, can be made to bear the same relation to the great work of technical education that Columbia College does to university education, and thus become a technical school second to none.

Dr. Gray recommends that the institute should offer a course of instruction covering the whole nine years of study; that it be divided into two distinct schools, a secondary and upper secondary, and a higher college or professional school. He advises that the secondary school commence above the grade schools, with a minimum age limit of 14 years, and that the course of instruction should include all the subjects commonly given in the best high schools, with the possible exception of Latin and Greek, and in addition the subjects more commonly given in business schools or colleges; along with this course of class room instruction, provision should be made for practical instruction, either manual or otherwise, bearing upon the particular branch of industry which the scholar intends to enter. The duration of this course should be about four years, as at present in city schools, but should be freed from a number of subjects that are of little use to the ordinary artisan class. Dr. Gray recommends a good sound course in English for students of the secondary school, but does not recommend a study of foreign languages.

One of the most important, if not the most important, recommendations made by Dr. Gray is that in regard to the upper school. I quote his language.

"This school can be made to fill the place which the present technical colleges have failed to do, namely, provide a college

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education for men of the rank of shop foremen, superintendents, etc. In this course, which should be of two years' duration, instructions can be given in such subjects as the design of structures and machinery, the properties of materials and machines, the design and management of power stations, telegraphy, and train signal systems, the surveying and construction of railway beds, civil engineer's and architect's office work, finer kinds of machine work and a host of other subjects, the understanding being that these subjects be treated in such a manner that practical information shall be the object rather than fundamental mathematical principles."

Other matters of importance are suggested in this part of Dr. Gray's report, one of which is that as there would probably be those in this course who would find it impossible to take the higher or technical college education, this upper secondary school would serve as a most excellent preparation for the same.

Dr. Gray recommends that the technical college or professional school be open only to a selected small number of students who have shown special fitness for the work, and that the entrance requirements should be considerably higher than is usual in existing technical colleges. For this department extensive laboratory practice is recommended and thorough drill in the methods of testing properties of matter and in investigational work. Dr. Gray—as indeed every member of the advisory board—thoroughly agrees with Dr. Barker that apparatus should not be merely toys, that they must subserve some real purpose in the activities of life. As Dr. Barker puts it: "Where shall we draw the line between a testing machine and a cohesion apparatus—between a calorimeter of a pint capacity (an apparatus) and one of 100 gallons (a machine)," etc.?

Dr. Gray suggests that this course might be of three years' duration and that fees be charged. Deserving students unable to bear the expense could possibly be provided with scholarships. Original research should be a prominent feature in this higher college.

Dr. Thurston's report to the committee is an exhaustive one,

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covering every phase of technical education, and as the commission will have it printed in full with the reports of other members of the board, I shall only give a few of the salient points in his paper.

Dr. Thurston assumes that the purpose of the institute will be primarily the useful education and technical training of the young people of Pittsburg, and especially of those belonging to the great body of wage earners, and that both sexes are, if practicable, to be equally well cared for. He divides these into classes: (*a*) Those who can come to the instructor and give their time as required to study, to lectures and to recitations, and (*b*) those who are compelled to work during the working hours of the establishments in which they are employed and can only be given instruction outside during the evening hours, usually in evening classes.

Dr. Thurston asks: "Is it practicable to carry into effect that ambition of every technical education, so admirably pictured by Scott Russell, 'the Technical University on the lines of which Ezra Cornell would have approved, where any man could secure instruction in any study in such departments as are capable of being utilized practicably in the sequel of life. It is obvious that could such an institution be founded, and thus the noble example be furnshed in full perfection, and a standard thus provided by which to measure, the establishment of this complete and perfect model would, very probably, advance the cause of useful education of the people, for the life and work of the people for many years. It is possible that the opportunity is here and now presented, and that, lost, it may not recur again.'"

The opportunity is one not simply to provide education of the most imperatively needed sort for the youth of Pittsburg, but it is an opportunity to establish a model of the most perfect and most widely useful institution of learning that has been conceived, and that shall, by force of example establish a standard and promote the most complete and perfect system of technical and liberal education anywhere.

The general scheme laid out for the great technical school by Dr. Thurston is as follows:

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(*a*) The college of mechanical engineering and the mechanic arts, with eight different departments of mechanical engineering.
(*b*) The college of civil engineering—with six departments.
(*c*) The college of architecture with three departments.
(*d*) The college of mines and metallurgy with two departments.
(*e*) The college of agriculture with six departments.
(*f*) The college of applied chemistry with four departments.
(*g*) The college of physics with two departments.
(*h*) The college of fine arts with three departments.
(*i*) The college of the business man with four departments.
(*j*) The college of navigation and marine transportation with two departments.
(*k*) The college of mathematics with two departments.
(*l*) The college of politics and economics with four departments.
(*m*) The college of languages and literature with four departments.
(*n*) The college of philosophical science and ethics.
(*o*) The college of biology.
(*p*) The preparatory college (standard curriculum).

"This scheme appears an ambitious one, but it so appears simply because we are in the very inception of educational work, and few persons have the slightest idea of the need or the opportunity for promoting the highest interests of the nation through a thoroughly systematized education."

Dr. Thurston refers with just pride to the Massachusetts Institute of Technology, the Armour Institute, the Pratt and Drexel Institutes, as well as to others of a similar character, giving the curriculum of that sterling school of technology, the Massachusetts Institute, as well as much valuable data regarding the faculty, equipments and graduate students, all of which is compared with the Royal Technical College at Berlin. Dr. Thurston, with every other member of the commission, lays particular stress upon the value of the secondary school which he chooses to call the technical high school and which it is evident will meet the needs of the largest number of people. He chooses for a typical illustration of this division of the scheme the splendid work of the Pratt Institute of Brooklyn. Dr. Thurston also emphasizes the great value of such a secondary school to the young men and women of Pittsburg particularly, and believes it is only carrying out Mr. Carnegie's wishes to develop this department to its fullest extent.

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As to the higher departments of the new school he expresses himself most charmingly in the language of John Russell on the occasion of the latter's visit to a German technical university: "A technical university abroad was to me a surprise, a profound lesson, a delight. It was a dream of my youth suddenly embodied in living substance, and, unlike other realized dreams, the reality excelled the fiction. It was one of my early dreams that highly educated men should engage in teaching skilled workmen the profound philosophical principles which underlie all material work, and I hoped so to make their work their pleasure, excellence their ultimate aim and truth of execution and perfection of finish their highest ambition."

Dr. Thurston proceeds to discuss the higher branch of technical education with special reference to the needs of Pittsburg, then gives us some valuable information as to the status of the faculty of the great school, quoting precedents in home and foreign institutions. Endowments are also discussed with a freedom that has opened our eyes to the vital importance of this part of the scheme, and to which I have already referred in this paper. Summarizing, Dr. Thurston says:

"The first step considered advisable in preparing to supply Pittsburg and its environs with an institution of high efficiency for technical instruction should be to make a plan of that final educational structure which is taken to represent the limit toward which progress is expected to advance. The actual construction of the scheme should be commenced with the most essential elements; the less immediately and imperatively needed parts should be arranged for later. In the present case it would probably be justifiable to assume that the aim of the school should be, first, to provide for the young people of Pittsburg needing elementary technical educational instruction and to organize for this purpose a technical high school with evening classes for pupils unable to attend regularly the day classes. This foundation being laid, the various developments which have been considered in the preceding pages may be added, each as the preceding element is completed, working continually toward the technical university and the highest ulti-

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mate divisions of the scheme, the department of experimental engineering and research.

"The method of organization would be that which best insures the management of the whole of the great scheme and of each of its subdivisions by men expert each in his own field, whether that of director of the technical university, principal of one of its schools, or professor or instructor, or workman in shop, drawing-room or laboratory. Such an organization of a staff of experts being provided, the administration will be certain to work smoothly and efficiently, without special attention to detail on the part of the trustees. Their largest problem will be the matter of securing the endowment and its income from deterioration in later years and consequent impediment or interruption of the enterprise.

"Every division of the institution, from lowest to highest and first to last, should be so planned as to work in concert with the public schools of similar grade as far as practicable. The technical high school might accept certificates from the academic high schools of the city and from other academies of similar rank; the pupils of the city schools might be given admission to the classes of the technical school in the shops and technical departments; a half-time school, as advocated by Professor Higgins, of Worcester, might possibly come of such mutual aid of city and technical schools. The technical school would be able, in some cases probably, to promote the initiation of special instruction in manual training and in the kindergarten forms of technical work in the public schools. Every possible means of allying the technical and the common school work should be availed of, and the cardinal principle should be constantly proclaimed and enforced: the purpose of the whole movement is to advance the best interests of the people of Pittsburg and its vicinity. It should be made distinctly understood that it is desired to make use of all possible ways to that end and to cooperate with every other educational movement."

In closing this far too lengthy paper I must acknowledge the great interest taken in the development of the scheme for the new technical school by th Engineers' Society of Western Pennsylvania, by the Women's Domestic Arts Association and by a

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number of eminent engineers, physicists and technologists at home and abroad; and the sole purpose of my paper is to ask the further cooperation and kindly advice of the members of this Association in formulating our plans, in steering clear of 'derelicts' and in making the Pittsburg Carnegie School of Technology what its generous patron wishes it to be and what the demands of this great industrial nation require it to be. Any communication sent Mr. Wm. McConway, chairman of our committee, Pittsburg, Pa., will be received and acknowledged with great pleasure.

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ZOOLOGY.

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ADDRESS

BY

CHARLES B. DAVENPORT,

VICE-PRESIDENT AND CHAIRMAN OF SECTION F, FOR 1900.

ZOOLOGY OF THE TWENTIETH CENTURY.

Looking over the vice-presidential addresses given before the American and British Associations during the past year or two in an eager search for suggestions, I found a prevailing tone of retrospect. The advance of science in the nineteenth century was a favorite theme, and little wonder in view of the century's marvelous events. Since by the arrangement of the council I lost my opportunity to be an end-of-the-century historian last year, I shall essay the role of a prophet this. On the historical side I could have given you something very interesting, I assure you. Not I, but the council that delayed my address to the following century, must be held responsible for the poor substitute I am able to present.

We have stood in retrospect at the close of the nineteenth century and marveled at what it brought forth. Here at the threshold of the twentieth century it is natural that we should wonder what it will unfold. Will the changes be as great, and in what direction will advance chiefly be made? I am the more content to consider such questions for three reasons: First, because we can use history to formulate predictions; second, because the attempt may possibly influence to some slight degree the future development of zoology; and third, because the attempt is tolerably safe, since we shall none of us know all that the century will bring forth.

Comparing the beginning of the twentieth century with that of the nineteenth, we find the most striking advances to have taken place in our morphological knowledge. The nineteenth

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may indeed be designated the morphological century. The demands of systematic zoology first made anatomical studies necessary. Later, comparison came to be accepted as the fundamental zoological method, and comparative anatomy, emancipated from its servitude to systematic zoology, became an independent science. Still later embryology arose, at first as a descriptive science and then as a comparative one. Out of embryology arose modern cytology, which in turn is creating a comparative histology. Partly as a result of studying embryology as a process has arisen the modern tendency toward comparative physiology. As a result of the general acceptance of the evolution doctrine, the study of the geographical distribution of organisms and of adaptations has gained a new meaning. From the great matrix of 'general biology' there has begun to crystallize out a number of well-defined sub-sciences.

Looking broadly at the progress made during the past century, we see that zoology has become immensely more complex, due to its developing in many lines and that the new lines are largely interpolated between the old, and serve to connect them. The descriptive method has developed into a higher type—the comparative; and of late years still a new method has been introduced for the study of processes—the experimental. The search for mechanisms and causes has been added to the search for the more evident phenomena. The zoologist is no longer content to collect data; he must interpret them.

In view of the past history of our science, what can we say of its probable future? We may be sure that zoology will develop in all these three directions: (1) The continued study of old subjects by old methods; (2) the introduction of new methods of studying old subjects; and (3) the development of new subjects.

I am not one of those who would belittle the old subjects, even when pursued in the old way. There is only one class of zoologist that I would wish to blot out, and that is the class whose reckless naming of new 'species' and 'varieties' serves only to extend the work and the tables of the conscientious synonomy hunter. Other than this all classes will contribute to the advancement of the science. No doubt there are unlabeled

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species, and no doubt they must, as things are, be named. And no doubt genera and familes must be 'revised' and some groups split up and others lumped. So welcome to the old-fashioned systematist, though his day be short, and may he treat established genera gently. No doubt there are types of animals of whose structure we are wofully ignorant; no doubt we need to know their internal anatomy in great detail. So welcome to the zootomist in this new century, and may he invent fewer long names for new organs. No doubt there are groups of whose relationships we know little and which have been buffeted about from one class to another in a bewildering way. We need to have them stay fixed. So welcome to the comparative anatomist and the embryologist, and may their judgment as to the relative value of the criteria of homology grow clearer. No doubt our knowledge of inheritance and development will be immensely advanced by the further study of centrosomes, asters and chromosomes. Welcome, therefore, to the cytologist, and may he learn to distinguish coagulation products and plasmolytic changes from natural structures. All these subjects have victories in store for them in the new century. To neglect them is to neglect the foundations of zoology.

But the coming century will, I predict, see a change in the methods of studying many of these subjects. In systematic zoology fine distinctions will no longer be expressed by the rough language of adjectives, but quantitatively, as a result of measurement. There is every reason to expect, indeed, that the future systematic work will look less like a dictionary and more like a table of logarithms. Our system of nomenclature, meanwhile, will probably break down from its own weight. Now that the binomial system of nomenclature has been replaced by a trinomial there is no reason why we should not have a quadrinomial nomenclature or even worse. It seems as if the Linnæan system of nomenclature is doomed. What will take its place can hardly be predicted. The new system should recognize the facts of place-modes and color varieties. We might establish certain categories of variation such as those of geographical regions, of habitat, of color. A decimal system of numbers might be applied to the parts of the country or the

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kinds of habitat, and the proper number might take the place of the varietal or subvarietal name. Thus the northeastern skunk might be designated *Mephitis mephitica* 74 and the southeastern skunk *Mephitis mephitica* 75 (adopting the Dewey system of numerals). The Maine skunk would then be 741; that of New York 747, and so on. This much for a suggestion.

So likewise for the morphologist the coming century will bring new aims and new methods. No longer will the construction of phylogenetic trees be the chief end of his studies, but a broad understanding of the form producing and the form maintaining processes. The morphologist will more and more consider experiment a legitimate method for him. The experimental method will, I take it, be extended especially to the details of cytology, and here cytology will make some of its greatest advances.

Not only will the old subjects be studied by new methods, but we have every reason to believe that new sub-sciences will arise during the twentieth century as they did during the nineteenth. Of course we cannot forecast all these unborn sciences, as cytology and neurology could hardly have been forecast at the beginning of the nineteenth century. But we can see the beginnings of what are doubtless to be distinct sciences. Thus comparative physiology is still in its infancy and is as yet hardly worthy of the name of a science; there is no question that this will develop in the coming decades. Animal behavior has long been treated in a desultory way, and many treatises on the subject are rather contributions to folk-lore than to science. But we are beginning to see a new era—an era of precise, critical and objective observation and record of the instincts and reactions of animals. One day we shall reach the stage of comparative studies, and shall have a science of the ontogeny of animal instincts. This will have the same importance for an interpretation of human behavior that comparative anatomy and embryology have for human structure.

Prominent among the advances of the century will be the ability to control biological processes. We shall know the factors that determine the rate of growth and the size of an animal, the direction and sequence of cell-divisions, the color, sex and

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details of form of a species. The direction of ontogeny and of phylogeny will be to a greater or less extent under our control.

The study of animals in relation to their environment, long the pastime of country gentlemen of leisure, will become a science. Some day we shall be able to say just what conditions an animal's presence at any place; and, more than that, we shall be able to account for the fauna—the sum total of animal life of any locality—and to trace the history of that fauna. This is at least one of the aims of animal ecology. It is a reproach to zoology that the subject of animal ecology should lag so far behind that of plant ecology. When zoologists fully awaken to a realization of what a fallow field lies here this reproach will quickly be wiped out. As it is, we have a notion that the factors determining the occurrence of an animal or of a fauna are too complicated to be unraveled. As a matter of fact, the factors are often quite simple. Let me illustrate this by some studies I have made this summer on the Cold Spring Beach. This beach is a spit of sand, 2,000 feet long and 50 to 75 feet broad, running from the western mainland into the harbor and ending in a point that is being made several feet a year through the cooperation of wave, tide and a silt-transporting creek of fresh water. On the outer harbor side is a broad, gradually sloping, sandy and gravelly beach, covered by high tide and devoid of living vegetation. Above that is a narrow zone—the middle beach—covered with débris of storms, supporting a few annual plants, and bounded above by a storm-cut bluff. Above is the upper beach, covered with a perennial, sand-loving vegetation. On the lower beach the zonal distribution of animals is striking. Just above the water are found the scavenger mud snails and, further up, a crowd of *Thysanura*—small insects that rise to the surface of the water when the tide comes in. These find a living on the finer débris or silt that settles on the pebbles during the high tides. In this zone also *Limulus* lays its eggs in the sand, and its nests are crowded with nematodes that feed on the eggs. During the breeding season scores of the female *Limulus* die here, and their carcasses determine a complex fauna. First, carrion beetles (*Necrophorus*) and the flesh fly live on the dead bodies; then the robber flies and

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tiger-beetles are here to feed on this fauna, and finally numerous swallows course back and forward gleaning from this rich field. At the upper edge of the lower beach is a band of débris dropped at slack water and consisting especially of shreds of *Ulva* and many drowned insects, chiefly beetles. At this zone, or just above under the drier but more abundant wreckage of the last storm, occur numerous Amphipoda of the genera *Orchestia* and *Talorchestia.* Associated with these marine creatures are numerous red ants, sand-colored spiders and rove-beetles. The amphipods feed on the decaying sea-weed. The ants are here looking chiefly for the drowned insects. Their nests are further up on the middle beach, but the workers travel to the edge of the high tide to bring away their booty. The rove-beetles are general scavengers. The spiders, which are mostly of the jumping sort (of the family *Attidoe*), feed on the active insects and amphipods. At a higher zone, and above all but the storm-driven tides, one finds the nests of the ants, especially under logs, certain predaceous beetles and the xerophilous grasshoppers and crickets. Finally, on the plant-covered upper beach one finds characteristic leaf-eating beetles, grasshoppers and carnivorous insects. Now all this seems commonplace enough and not especially instructive, and yet if you go to the shore of Lake Michigan you will find on a similar beach closely similar, if not identical, forms (excepting the beach fleas and the horseshoe crabs) you will find similar ants, spiders, rove-beetles, tiger beetles and sand grasshoppers. This fact alone shows the greater importance of habitat over geographical region in determining the assemblage of animals that occurs in any one place. It may be predicted that studies on the relation of animals to their habitat will multiply, that they will become comparative and that the science of animal ecology will become recognized as no less worthy and no less scientific than the science of morphology.

Studies on the origin of species were far from being unknown in the nineteenth century, but they were for the most part fragmentary, or speculative, or narrow in view. The opinion that there was one method of evolution seemed to hold sway. It seems to me that the signs of the times indicate that we are

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about to enter upon a thorough, many-sided, inductive study of this great problem, and that there is a willingness to admit that evolution has advanced in many ways. The attempt, therefore, to explain all specific peculiarities on the ground of natural selection, or on the ground of self-adjustment, or on the ground of sport preservation through isolation, we may expect equally to prove futile. All these causes are no doubt real in some cases, but to exclude any one or to deny that new causes may be found in the future is equally dangerous and unscientific.

It is often said that the factors of evolution are inheritance and variation. In the new century careful and quantitative studies will be made on these factors. We shall get at quantitative expressions of the more complicated forms of heritage in the same way as Galton has given us an expression of a simple form of inheritance. We shall hope to understand why some qualities blend and others refuse to do so. We shall learn the laws of mingling of qualities in hybrids and get an explanation of the monstrosities and the sterility which accompany hybridization. What we call reversion and prepotency will acquire a cytological explanation, and it may be that the theory of fertilization will be seriously modified thereby. When we can predict the outcome of any new combination of germ plasms then, indeed, we shall have got at the laws of inheritance.

As for the other factor, that of variation, I anticipate interesting developments in our knowledge of its laws and of its causes. The methods by which this knowledge is to be acquired are doubtless comparative observation, experimentation and a quantitative study of results. Within the last decade a profound student of variation (Bateson) has declined to discuss its causes, holding that we had no certain knowledge of them. Even the categories of variation are still unenumerated. The science of variation is therefore one of those that we may hope to see established in this century. I feel convinced that statistical studies are first of all necessary to lay the foundations of the science.

As an illustration of an applicaton of statistics to evolution studies I will give some account of my work during the past

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two years on the scallop of our east coast, *Pecten irradians.*

Pecten irradians is a bivavle mollusc of flattened, lenticular form, that inhabits our coast from Cape Cod southward. The Cape Cod limit is a rather sharp one, but southward our scallop passes gradually into the closely related forms of the South American coast. This fact would seem to indicate its southerly origin. To get light on the evolution of the group, I have studied and measured over 3,000 shells, chiefly from four localities: (1) Cold Spring Harbor, Long Island; (2) Morehead, North Carolina; (3) Tampa, Florida; and (4) the late Miocene or early Pliocene fossils of the Nansemond River. The fossil shells, to which I shall frequently refer, were found imbedded in the sand at Jack's Bank, one mile below Suffolk, Virginia. The bank rises to a height of 25 to 30 feet. Shells were obtained from three layers, respectively, one foot, six feet and 15 feet above the base of the bluff. Of course, the upper shells lived later than the lower ones and may fairly enough be assumed to be their direct descendants. The time interval between the upper and lower levels cannot be stated. As I have measured sufficient shells from the bottom and top layers only, I shall consider them chiefly. I wished to get recent *Pectens* from this locality, but the nearest place where they occur in quantity is Morehead, North Carolina. These *Pectens* may therefore stand as the nearest recent descendants of the *Pectens* of the Nansemond River.

The *Pecten* shells have a characteristic appearance in each of the localities studied. After you have handled them for some time you can state in 95 per cent. of the cases the locality from which any random shell has come. First of all, the shells differ in color, especially of the lower valve. In the specimens from Cold Spring Harbor this is a dirty yellow; from Morehead, yellow to salmon; from Tampa, white through clear yellow to bright salmon. Second, the antero-posterior diameter of a shell becomes relatively greater than the vertical diameter as you go north. Thus, the antero-posterior diameter exceeds on the average, the dorsoventral diameter: at Tampa, by about 1.5 mm.; at Morehead, 2.5 mm.; and at Cold Spring Harbor, 6 mm. The fossil *Pectens* have an excess of about 4 mm.

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Comparing the fossils with the *Pectens* of Morehead we find, as shown above, that the fossils are more elongated. Comparing the depth of the right valves having a height of 59 mm., we get:

From the lowest level, Jack's Bank	8.8 mm.
From the highest level, Jack's Bank	9.1 mm.
From Morehead	19.7 mm.

Hence the recent shells are much more nearly spherical than the fossils; there is a phylogenetic tendency toward increased globosity.

The average number of rays in the different localities is as follows:

Lower level, Jack's Bank	22.6
Middle level, Jack's Bank	22.1
Upper level, Jack's Bank	21.7
Morehead and Cold Spring Harbor	10.3
[Tampa	20.5]

Here it appears that there is a phylogenetic tendency toward a decrease in the number of rays of *Pecten irradians*. To summarize: The scallop is becoming, on the average, more globose, and the number of its rays is decreasing and its valves are probably becoming more exactly circular in outline. The foregoing examples illustrate the way in which quantitative studies of the individuals of a species can show the change in its average condition both at successive times and in different places.

But the quantitative method yields more than this. It is well known that if the condition of an organ is expressed quantitatively in a large number of individuals of a species the measurements or counts made will vary, *i. e.*, they will fall into a number of *classes*. The proportion of individuals falling into a class gives what is known as the 'frequency' of the class. Now it appears that in many cases the middle class has the greatest frequency (and is consequently called the mode) and as we depart from it the frequency gradually diminishes, and diminishes equally at equal distances above and below the mode. One can plot the distribution of frequencies by laying off the successive classes at equal intervals along a base line and drawing perpen-

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diculars at these points proportional in length to the frequency. If the tops of these perpendiculars be connected by a line there is produced a 'frequency polygon.' The shape of the frequency polygon gives much biological information. When the polygon is symmetrical about the model ordinate we may conclude that no evolution is going on; that the species is at rest. But very often the polygon is more or less unsymmetrical or 'skew.' A skew polygon is characterized by this: that the polygon runs from the mode further on one side than on the other. This result may clearly be brought about by the addition of individuals to one side or their subtraction from the other side of the normal frequency polygon. The direction of skewness is toward the excess side. The skew frequency polygon indicates that the species is undergoing an evolutionary change. Moreover, the direction and degree of skewness may tell us something of the direction and rate of that change. There is one difficulty in interpretation, however, for a polygon that is skew may be so either from innate or from external causes. In the case of skewness by addition we may think that there is an innate tendency to produce variants of a particular sort, representing, let us say, the *atavistic* individuals. In this case skewness points to the past. The species is evolving *from* the direction of skewness. In the case of skewness by subtraction there are external causes annihilating some of the individuals lying at one side of the mode. Evolution is clearly occurring away from that side and *in* the direction of skewness.

Now so far as we know at the present time there is no way of distinguishing skew polygons due to atavism from such as are due to selective annihilation. But in many cases at least the skewness, especially when slight, can be shown to be due to atavism; and this is apparently the commoner cause. This conclusion is based first upon a study of races produced experimentally and whose ancestry is known, and secondly upon certain cases of compound curves. Take the case of the ray flowers of the common white daisy. A collection of such daisies gathered in the fields of DeVries gave a mode of 13 ray-flowers with a positive skewness of 1.2. The 12- or 13-rayed wild plants

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were selected to breed from, and their descendants, while maintaining a mode at 13, had the increased positive skewness of 1.9. The descendants of the 12-rayed parents had a stronger leaning towards the high ancestral number of ray flowers than the original plants had. The 21-rayed plants were also used to breed from. Their descendants were above the ancestral condition as the descendants of the 12-rayed plants were below. The skewness —0.13 is comparatively slight. In this case we have experimental evidence that polygons may be skew *toward* the original ancestral condition.

Of the compound polygons it is especially the bimodal polygon that frequently gives hint of two races arising out of one ancestral, intermediate condition. Consequently we should expect the two constituent polygons to be skew in opposite directions; and so we usually find them to be. For example, Bateson has measured the horns on the heads of 343 rhinoceros beetles and has got a bimodal polygon. The polygon with the lower mode has a skewness of +0.48; that with the higher mode a skewness of —0.03. One might infer that the right-hand form, the long-horned beetles, had diverged less than the short-horned from the ancestral condition. Again, as is well known, the chinch bug occurs in two forms—the long-winged and the short-winged. Now, in a forthcoming paper my pupil, Mr. Garber, will show that the frequency polygon of the short-winged form has a skewness of +0.44, while that of the long-winged form has a skewness of —0.43. On our fundamental hypothesis the ancestral condition must have been midway between the modes.

Still a third class of cases that gives evidence as to the significance of skewness is that where two place modes have moved in the same direction but in different degrees. Thus the index (breadth ÷ length) of the shell of *Littorina littorea,* the shore snail, as measured by Bumpus, has at Newport a mode of 90, at Casco Bay of 93. The skewness is positive in both places and greater (+0.24) at the more southern point than at Casco Bay (+0.13). This indicates that the ancestral races had a higher index even than those of Casco Bay, probably not far

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from 96, and also that the *Littorina littorea* of our coast came from the northward, since the northern shells are the rounder. We have historical evidence that they did come from the northward. Likewise the *Littorinas* from South Kincardineshire, Scotland, have a modal index of 88 and a skewness of +0.065, while those of the Humber, with a mode of 91 have a skewness of +0.048. These figures suggest that if the mode were 97 the skewness would be 0, and this would give practically the same value to the ancestral index as arrived at for the *Littorinas* of our coast. It will be seen from these illustrations that the form of the frequency polygon may be of use in determining phylogeny.

While skewness is thus often reminiscent, we must not forget the possibility that it may be, in certain cases, prophetic. This has come out rather strongly in a piece of work I have been engaged on during the past year. I have been counting the number of rays in recent *Pecten irradians* from various localities and have obtained in some cases evident skewness in the frequency polygons. To see what phylogenetic meaning, if any, this skewness has I sought to get a series of late fossils. After careful consideration I was led to go to the Nansemond River for the late Tertiary fossils found there and already referred to. These served my purpose admirably. We may now compare the average number of rays from the two extreme layers at Jack's Bank and at Morehead with the indices of skewness of the frequency polygons from the same localities.

Place.	Avg. No. of rays.	Index of skewness.	σ
Morehead, N. C.	17.3	—0.09	0.81
Upper layer, Jack's Bank	21.7	—0.16	1.0
Lower layer, Jack's Bank	22.6	—0.22	1.24

This series is instructive in that it tells us that the gradual reduction in the number of rays has been accompanied at each preceding stage by a negative skewness. This skewness was thus *prophetic* of what was to be. The skew condition of the frequency polygon we may attribute to a selection taking place

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at every stage, and the interesting result appears that the selection diminishes in intensity from the earliest stage onward. It is as though perfect adjustment were being acquired. If adjustment were being perfected we might expect a decrease in the *variability* in the rays at successive periods. And we do find such a decrease. This is indicated in the last column where *o* stands for the index of variability. From this column it appears that the variation in the number of rays has diminished from 1.24 rays in the Miocene to 0.81 ray in recent times. This fact again points to an approach to perfection and stability on the part of the rays. Just why or wherein the reduced number of rays is advantageous I shall not pretend to say. It is quite possible that it is not more advantageous, but that there is in the phylogeny of *Pecten irradians* an inherent tendency towards a reduction in the number of multiple parts. As a matter of fact there are other *Pectens* in which the number of rays is less even than in *irradians*.

The reduction in the variability of the rays with successive geological periods has another interest in view of the theory of Williams and Rosa, according to which evolution and differentiation have of necessity been accompanied by a reduction in variability. Evolution consists, indeed, of a splitting off of the extremes of the range of variation, so that in place of species with a wide range of variability we have two or three species each with a slight range of variability. In the particular case in hand, however, it is not certain that the lower Jack's Bank form-unit (named *Pecten eboreus* by some one) has given rise to any other form than something of which *Pecten 'irradians'* of Morehead is a near representative. The evidence indicates that the reduced variability is solely the effect of the skewing factors.

The upshot of this whole investigation into the biological significance of skew variation is then this: Skewness is sometimes reminiscent and sometimes prophetic. In our present state of knowledge it is not possible by inspecting a single skew curve to say which of the two interpretations is correct in the given case. But by a comparison of the frequency curves of allied form-units the state of affairs can usually, as in the ex-

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amples given, be inferred. A method of interpreting the single skew curve is a discovery for the future.

I realize that I have been bold, not to say rash, in this attempt to forecast the zoology of the twentieth century. I suppose, after all, I have merely expressed my personal ideals. Let those comfort themselves, threfore, who like my picture not and let them draw one more to their taste. These matters of detail are after all less important; but the general trend of the science I believe to be determined by the great general laws that will hold, whatever the detailed lines of development. First, students of the science wll cling closer to inductive methods without abandoning deduction. Speculative web-spinning will be less common, will be less attractive and will be more avoided by naturalists of repute. Great generalizations will be made, of course, but made with caution and founded at every step on facts. Second, the science will deal more with processes and less with static phenomena, more with causes and less with the accumulation of data. The time is coming when the naturalist who merely describes what he sees in his sections will have neither more nor less claim for consideration than he who describes a new variety of animal. It is relations, not facts, that count. Third, the science will become experimental, at least in so far as it deals with processes. Nothing will be taken for granted that can be experimentally tested. Better experimental laboratories will be founded and larger experimental stations, such as Bacon foresaw in the new world, will be established. Fourth, the science will become more quantitative. This is the inexorable law of scientfiic progress, at least where processes are concerned. I repeat that there is no reason to expect or desire the abandoning of the lines of work already recognized and followed for a half century or more. Rather holding fast to and extending the old lines of investigation, zoology will be enriched by new fields of study lying between and uniting the old. As chemistry and physics are uniting and occupying the intervening field, as geology and botany are coming close together in plant ecology, so will zoology and mathematics, zoology and geology, zoology and botany find untouched fields between them and common to them. Working in these new

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fields and by the aid of new methods, the naturalist of the future will penetrate further into the nature of processes and unravel their causes."

The zoology of the twentieth century will be what the zoologist of the twentieth century makes it. One hundred years ago the prerequisites of the naturalist were few and the opportunities of getting them were small. He must have studied with some master or have worked as an assistant under a naturalist in some museum. The places were few, the masters often difficult of approach. Now while, on the one hand, the training required is vastly more exacting, on the other hand, the opportunities are generous. Just because of the fact that zoology is spreading to and overlapping the adjacent sciences, the zoologist must have his training broadened and lengthened. A zoologist may well be expected to know the chief modern languages (let us hope this requirement may not be further extended), mathematics through analytics, laboratory methods in organic as well as inorganic chemistry, the use of the ordinary physical instruments, advanced geology and physiography, botany, especially in its ecological, physiological and cytological aspects, and animal paleontology. The list of prerequisites is appallingly long; zoologists of the future wil be forced to an earlier and narrower specialization, while at the same time they must lay a broader foundation for it.

But if the prerequisites of the zoologists are to be numerous their acquisition will be easy. Even now scores of universities put the services of the best naturalists at the disposal of students and offer free tuition and living to come and study with them. Librarians, great museums, great teachers are made available to him who would work and has the requisite capacity.

All these advantages will, however, count for nothing if zoological research does not attract the best men, and if the best men be not accorded time and means for research. Our best students slip from our grasp to go into other professions or into commerce because we can offer them no outlook but teaching, administration, and a salary regulated by the law of supply and demand. We must urge without ceasing upon college trustees

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and corporations the necessity of freedom for research and liberal salaries if America is to contribute her share to the advance of zoology in the twentieth century.

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ADDRESS

BY

AMOS W. BUTLER,

VICE-PRESIDENT AND CHAIRMAN OF SECTION H, FOR 1900.

A NOTABLE FACTOR OF SOCIAL DEGENERATION.

The subject to which I propose to call your attention cannot be said to be a new one, though I do not think that it has ever been presented before this Section. I wish to speak for a short time on one of the phases of social anthropology, in which I am very greatly interested. My theme is the problem of the feeble-minded. This term is now generally used to include all persons from those with weak minds to the most abject idiot. Perhaps most of us have met with a few individuals of this class. Almost every community contains one or more of these degenerates. The aggregate for our country, however, makes a mighty host. We do not know how many feeble-minded persons there are in the United States. The census of 1890 gives 95,571 individuals of that kind. From Pennsylvania there were reported that year 8,753; Ohio, 8,035; Indiana, 5,568; Iowa, 3,319; Kansas, 2,039; Colorado, 192. What the increase since then has been I do not know. The present census does not give any figures on this point; therefore any effort to ascertain the number can be but an estimate. These feeble-mnded persons are distributed throughout our land, not in the same proportion everywhere. They are not so notable in some localities as in others. In some places they are so few or inconspicuous as scarcely to be recognized. On the contrary, elsewhere their presence is strikingly manifest, and they, in one way or another, make a deep impression upon society that must endure through succeeding generations. The feeble-minded are found under many conditions. There are children and men

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and women. It is as children and as adults in their more active years that most of us know them best. Our social organization is made up of many factors. Some are constructive, some destructive. The feeble-minded are a disturbing element. Their life is a degenerating social force.

Some of the children with stronger mental powers enter the public schools. They may make some progress for a time, but whether they do or not, they must soon drop behind because they are unable to keep up with their work. Others roam the streets; the boys become the butt of the neighborhood, they are led into pranks, too often into vices, and seem to possess a peculiar tendency to immorality. The girls, many of them strong, well-appearing, with no one to teach them aright, and without strength of mind to protect themselves against the temptations which surround them, too early and too often fall into vice. "It is impossible to think of the evil of feeble-mindedness without heeding the curse of vice and illegitimacy which are its inevitable accompaniments. In the feeble-minded person the animal passions are usually present and are often abnormally developed, while will and reason, which should control and repress them, are absent. The feeble-minded woman, thus lacking the protection which should be her birthright, falls easily into vice. She cannot in her weakness resist the persuasions and temptations which beset her. When her baser passions are strong, she must oppose not only the influences from without but her own dominating desires. She is not to be condemned and punished, but rather to be pitied and helped in every possible manner." (Bicknell, Proc. Fourth Indiana State Conf. of Char. and Corr., 1895, p. 64.) Many of these poor creatures are easily attracted by an immoral life. Once begun, the pace is rapid, the course is always the same. It is impossible to tell or even to conceive of the depths of degradation to which they go. Dr. Kerlin, in 1884, in his report to the National Conference of Charities and Correction speaks of moral imbecility, showing its blighting and demoralizing effects. He shows how crime, vice and depravity are spread by neglected feeble-minded or imbecile person. He says, "There is no field in political economy which can be worked to better

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advantage for the diminution of crime, pauperism and insanity than that of idiocy." (Proc. Nat. Conf. of Char. and Cor., 1884, pp. 257 and 258.)

One perverted feeble-minded woman can spread throughout a community an immoral pestilence which will affect the homes of all classes, even the most intelligent and refined. The sight of such conditions or a knowledge of them must have a deadening effect upon the finer sensibilities of all.

These defectives usually also become dependents for a part of, if not all, the time. They may depend upon private charities or, when possible, upon the overseer of the poor. They frequently live in the poorest quarters of our towns and cities amid squalor and dirt, or occupy miserable huts in the least desirable localities of rural communities. It is not unusual for two or more families to live near each other or associate together. Marital ties are often lightly regarded. Frequently such bonds have not been entered into.

When these feeble-minded persons become helpless or learn the habit of regular public dependence, they find their way to poor asylums, the children being placed in such orphans' homes as will accept them. To one who visits the poor asylums and orphans' homes where they are received, the idiotic and feeble-minded are striking objects. In every one of the ninety-two poor asylums in my own State, Indiana, there are to be found inmates of this class, the greatest number in any one institution being 25; the lowest, 2. In many, their presence is emphasized by pitiable cases, individuals who are almost uncontrollable, or by infants, the offspring—in most cases the illegitimate offspring—of parents, one or both of whom are feeble-minded. The records at hand show that there are 970 feeble-minded persons in the Indiana poor asylums. (Rept. Board of State Char. of Indiana, 1900, p. 73.) Almost all these are adults. Many are in some degree helpless and all require more or less care. They have grown up without discipline; they lack such training as is possible with their dwarfed minds or strong hands; they are not only incapable of earning their own support, but, in a large number of instances, are the objects of continual anxiety to those in charge. This is particularly the case

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with feeble-minded women. Four hundred and eighty unfortunates of this sex are to be found in our county asylums, comprising 49.5 of their total feeble-minded population. Under our system of care it is only by the utmost watchfulness that the sexes are kept apart. Where proper facilities for sex separation are wanting, or the overwatch is not strict, there is to be found a continual increase of feeble-mindedness. This brings an increasing burden of expense upon the taxpayers in such counties.

I am compelled to speak specifically of Indiana, because we know more of the facts concerning conditions that exist there than we do of those elsewhere.

From information received, however, it is believed that they are not materially different from those existing in other States similarly situated. Perhaps in a general way the conditions there may be said to be the average of what is true of all our States.

To quite a large number of our poor asylums the inmates often come and go at will. The absence of the feeble-minded is especially noted during the summer season. They then go to visit friends or wander about the country. Any kind of shelter will answer their purpose and food is easily obtained. Quite a number of the women return to the poor asylum to become mothers.

In a certain county in the southern part of the State is a family of sixteen persons, representing three generations. Twelve of its members are the direct descendants of a feeble-minded blind man and his feeble-minded, partially blind, wife. The husband and wife have been inmates of the poor asylum off and on for thirty-five years. Generally wintering in the institution, they spend the summer roaming about the country, living in the woods. In unfavorable weather they seek an old hut or rail pen for shelter. They are said to make a bed of leaves or straw and live on what they can beg, supplemented by wild fruits and nuts. They have a feeble-minded daughter who is also partially blind. She has been twice married and has borne two feeble-minded daughters and three feeble-minded sons. Another feeble-minded and partially

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blind daughter has spent the greater part of the last twenty-two years in the poor asylum of an adjacent county and has been the mother of four illegitimate children. In this family of sixteen persons, nine are feeble-minded (three of these being also partially blind) and four are known to be illegitimate.

In an adjoining county are a husband and wife, both degenerates, who make the poor asylum their home in winter and live elsewhere in summer. It is no uncommon thing, in the spring following these wanderings, to have the family increased by a little mite of humanity which does not seem as if it could live. Many such children do live, however. This woman has borne eleven children and six of them are alive. One summer the family lived in a little shed built of short boards obtained from dry-goods boxes, old tin and carpets, along the railroad right-of-way, and obtained its living principally from begging. This family has just made a beginning. How extensive it may become depends upon what measures are taken. It has probably been an expense of $1,000 per year to the county.

Occasionally the children of normal parents are feeble-minded. As Mr. Bicknell has well said, there is no method of diverting the course. While it is easily possible for parents of normal faculties through dissipation, vice or disease to produce feeble-minded offspring, there seems to be no method by which the tendency can be reversed and the degeneration, thus easily accomplished, displaced by regeneration and restoration in succeeding generations. (Fifth Rept. of Indiana Board of State Charities, 1894, p. 51.)

Usually, and in a large number of cases, feeble-minded children are the offspring of feeble-minded parents. It is equally true that in the majority of cases the children of feeble-minded parents are feeble-minded.

From what has been said may be gathered that the question before us presents two notable evils:

(*a*) The increasing number of illegitimate children of feeble-minded parents.

(*b*) The inheritance of feeble-mindedness.

In the office of the Board of State Charities of Indiana there has been collected, from every reliable source, during the past

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twelve years, a great mass of material relating to this group of defectives. It embraces much that has been gathered by the Indiana School for Feeble-minded Youth especially through the efforts of Mr. Alexander Johnson, its able superintendent. In addition, it contains such information as could be obtained from the Poor Asylum and Orphans' Home records and from the township trustees who are *ex-officio* overseers of the poor. I know of no such a series of records nor one so conveniently arranged. Mr. Ernest P. Bicknell, formerly the Secretary of the Board of State Charities, some years ago prepared two papers based upon a part of this material. (Proc. Indiana State Conf. of Char. and Cor., 1895, p. 60; Proc. National Conf. of Char. and Cor., 1897, p. 219.)

With the fuller amount of data from these records at hand I have thought to present some illustrations obtained from it at this time.

Perhaps I may say a word as to the method of registration used in this work. From all our institutions regular reports are required. Some of these are made monthly, others quarterly. They are arranged with headings for all the principal facts in the individual and family history of each inmate. It is desired to have them filled as fully as the information obtained will permit. In addition to the regular institution records, information is sought as to the age, nativity, sex, color, mental and physical condition, and whether illegitimate. If parents are known we ask for their names and specific information as to whether either is affected with insanity, feeble-mindedness, deafness, blindness, paralysis, or whether either was a pauper, criminal or drunkard. This information, when obtained, is transferred to a card registration, where the cards are kept in duplicate, one series arranged alphabetically, the other by institutions. To the information at hand every fragment that is learned is added.

I have taken from these records some information concerning 511 families in which there is known to be feeble-mindedness. If there was any question regarding any family it was omitted. No such collection of these families has heretofore been reported upon. The number of persons known to be represented

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in them is 1,924. This is an average of 3.76 persons in each family. 1,343 of these persons are supported in public institutions. It is known, however, that these are not all the family representatives. They are the family members of whom we have accurate information. In it are included not only direct descendants, but those related by marriage.

Of this number of persons, 889, 46.2 per cent. were men; 1.035, 53.7 per cent. were women. 1.249—64.9 per cent., 532 men and 717 women, were feeble-minded; 54, 21 men and 33 women, were insane; 44, 25 men and 19 women, were otherwise defective. These last include blind, deaf, paralytics, and epileptics. 577, 311 men and 268 women, were normal or their defectiveness was unknown. Every person concerning whom positive information was not known was included in this latter group. In a number of cases there are combinations of defectiveness. One was insane and deaf, another feeble-minded, deaf and epileptic. Consequently, if we undertake to separate them we find there are 79 epileptics, 31 men and 48 women; 35 blind, 17 men and 18 women; 21 deaf, 6 men and 15 women; 19 paralytics, 8 men and 11 women; with combined mental and physical defects 101, 34 men and 67 women. Of these family members, 267, 13.8 per cent., 141 men and 126 women, are known to have been illegitimate.

What about the parentage of these individuals? In a large number of cases the characteristics are unknown. It is a matter of record that in 1,042 cases (over 54 per cent. of the whole) either one or both parents were defective. Of these in the cases of 666—348 males and 318 females, the mother was defective. In the case of 151, 83 males and 68 females, the father was defective, the mother unknown or normal. Both parents were defective in 225 instances, 122 males and 103 females. It will be seen that the records show the mother defective in 34.6 per cent. of the total number of cases noted herein, while only 7.8 per cent. of the fathers were defective, and both parents were defective in 11.6 per cent. instances. One cause of this difference, perhaps the chief one, is that the mothers, for various reasons which will occur to you, are often known when the fathers are not. The parents of 860 of the 1,924 children, 326 men

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A TABLE OF 511 FEEBLE-MINDED FAMILIES CONTAINING 1924 PERSONS.

	Males.	Females.	Total.
In public institutions	617	726	1343
Feeble-minded	499	652	1151
Insane	20	31	51
Epileptic	8	10	18
Blind	10	2	12
Deaf	3	5	8
Feeble-minded and epileptic	21	31	52
Feeble-minded, paralytic and epileptic	1	3	4
Feeble-minded and blind	6	14	20
Feeble-minded and paralytic	3	7	10
Feeble-minded and deaf	1	8	9
Feeble-minded, deaf and epileptic	1	1	2
Feeble-minded, blind and epileptic	..	1	1
Blind and paralytic	1	..	1
Paralytic	3	1	4
Blind and epileptic	..	1	1
Insane and epileptic	..	1	1
Insane and deaf	1	1	2
Unknown or normal	311	266	577
Illegitimate	141	126	267
Total	889	1035	1924

PARENTAGE OF ABOVE 1924 PERSONS.

	Males.	Females.	Total.
Mother f. m. Father unk. or normal	307	289	596
Mother f. m. and ep. Father unk. or normal	4	7	11
Mother f. m. and bl. Father unk. or normal	2	3	5
Mother f. m. Father f. m. and ep	3	7	10
Mother f. m. and ep. Father f. m	1	..	1
Mother f. m. and df. Father unk. or normal	..	1	1
Mother f. m. and par. Father unk. or normal	1	1	2
Mother f. m. Father par	..	2	2
Mother f. m. Father bl	8	7	15
Mother f. m. Father insane	3	2	5
Mother f. m. and bl. Father unk. or normal	2	..	2
Mother insane. Father unk. or normal	23	14	37
Mother blind. Father unk. or normal	4	..	4
Mother ep. Father unk. or normal	4	2	6
Mother insane. Father f. m	14	9	23
Mother ep. Father f. m	1	..	1
Mother unk. or normal. Father f. m	75	61	136
Mother unk. or normal. Father ep	2	1	3
Mother ins. and ep. Father unk. or normal	1	1	2
Mother unk. or normal. Father par	..	2	2
Mother unk. or normal. Father f. m. and bl.	2	..	2
Mother unk. or normal. Father insane	3	3	6
Mother unk. or normal. Father blind	1	1	2
Mother ep. Father f. m. and bl	1	1	2
Parents insane	5	2	7
Parents f. m. and bl	..	2	2
Parents related	10	12	22
Parents D. and D	1	1	2
Parents unknown or normal	326	534	860
Parents f. m	85	70	155

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FEEBLE-MINDEDNESS AND RELATED DEFECTS, TOGETHER WITH ILLEGITIMACY IN 511 FAMILIES.

	Whole number.	Feeble-minded.	Epileptic.	Insane.	Blind.	Deaf.	Paralytic.	Illegitimate.
Males	889	532	31	21	17	6	8	141
Females	1035	717	48	33	18	15	11	126
Total	1924	1249	79	54	35	21	19	267
Number of families	511	..	..	..	..	..	..	..
Average number of persons to each family	3.76	1.54	..	..	..	..	..	..
Per cent. of whole number	..	64.9	4.1	2.8	1.8	1.0	0.9	13.8
Percentage of males	..	59.8	3.5	2.3	1.9	0.6	0.9	15.8
Percentage of females	..	69.3	4.6	3.1	1.7	1.4	1.0	12.1

and 534 women, an aggregate of 44.6 per cent., were either unknown or were known to be normal. In but 22 instances (1.1 per cent.) were the parents reported to be relatives. This was true in the case of 10 men and 12 women.

The physical and mental condition of the parents of these 889 males is more specifically given as follows:

		Per cent.
Mother defective, father unknown or normal	348,	or 39.1
Father defective, mother unknown or normal	83,	or 9.3
Both parents defective	122,	or 13.7
Parents unknown or normal	326,	or 36.6
Parents related	10,	or 1.1
	889	99.8

141, or 15.8 per cent., of the males are illegitimate.

The physical and mental conditions of the parents of these 1,035 females more particularly stated is as follows:

		Per cent.
Mother defective, father normal or unknown	318,	or 30.7
Father defective, mother normal or unknown	68,	or 6.5
Both parents defective	103,	or 9.9
Parents unknown or normal	534,	or 51.5
Parents related	12,	or 1.1
	1,035	99.7

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('Defective' in the above means either mentally or physically defective.)

Of the 717 feeble-minded women, 163, or 22 per cent. have had illegitimate children. These 163 women have had 248 children, an average of 1.52 each. They range in number from 1 to 8 to the mother.

Perhaps it is well to refer to a few illustrations of the ancestors of the persons whom we have been discussing.

In one of the county poor asylums of Indiana, years ago, were a man and his wife, who are reported to have been of a low grade of intelligence, if not actually feeble-minded. The direct descendants of this couple, with those who entered the family through marriage, number 67, comprising three generations. One of the men, who is fairly bright, has raised a good family; another is an intelligent barber; two men have served in the army, but the majority of the family are feeble-minded, illiterate and of low morals, and their history is one of drunkenness, prostitution and crime. The marriage relation has been lightly regarded, and doubtless many of the unions were those of common law. Some of these persons are self-supporting, but a much larger number of them are or have been supported by the public in county or state institutions.

One woman I recall is the mother of eleven children, ten of them by one husband, one by another. A feeble-minded man whose history is known to us, was father of twenty children but was married several times.

Another group of 241 families in which there are two or more generations of feeble-mindedness has 970 persons who are blood relations, that is an average of 4.02 to each family. Of these families, 221 have two generations of feeble-mindedness, sixteen have three generations, three have four generations and one has five generations. The number of direct descendants who are feeble-minded is known to be 726. That is to say, 74.8 per cent. are feeble-minded. Does anything else reproduce itself so surely? In additon to this there are 25 who show other evidences of defectiveness. But 197 are normal or their mental and physical condition is unknown.

In the first generation 103 men and 203 women (306) were

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the parents of 248 children. Of these 84 were males and 164 were females. It is observed that almost twice as many women as men were known as parents in the first generation. The reason is the women were principally poor asylum inmates who were permitted to leave the institution and either live among relatives of a similar stage of mentality or roam the country. They returned to the poor asylum as a maternity house and nothing was learned or recorded of the paternity of many of the children. Most of the families obviously are of two generations. The child and parent are reported, and often nothing has been learned of an earlier ancestor. Where there are three or four generations some of the older members are dead, so that the amount of information concerning them is scant. On the other hand the later generation is represented by one or more children, many of them so young that their mental state cannot be determined.

In the second generation there were 548 persons, 304 males and 224 females. Of these, 26 were parents of the third generation. Of the latter, seven were parents of the fourth generation. From it came the single parent of the fifth generation. In the first generation there were 267 individuals of 306, or 87 per cent., who were feeble-minded; in the second generation 386 of 548, or 70 per cent., were so recorded; in the third generation 59 of 95, or 62 per cent., were so noted; in the fourth generation 13 of 20 cases, or 65 per cent., were given as feeble-minded; in the fifth generation the single representative is reported as feeble-minded. The aggregate showing, as noted, is that 74.8 per cent. of the descendants of these feeble-minded ancestors are feeble-minded. Other defects among the children are noted as follows: Insane, 3.4 per cent.; epileptic, 3.8 per cent.; blind, 2 per cent.; deaf, 8 per cent.; paralysis, 9 per cent.; both mentally and physically defective, 5.5 per cent. 107, or 11 per cent. were reported as illegitimate.

It will be observed that the feeble-minded and blind are more common than any other combination in the first generation, while in the second and third generations there are more feeble-minded and epileptics.

In one neighboring county a feeble-minded woman, who,

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A TABLE OF 241 FAMILIES EACH CONTAINING TWO OR MORE GENERATIONS OF FEEBLE-MINDEDNESS REPRESENTED BY 970 INDIVIDUALS.

No. families of two generations of feeble-mindedness ...	221
" " " three " " " ...	16
" " " four " " " ...	3
" " " five " " " ...	1
	241
Total number of persons ...	970
Average to each family ...	4.02

	First generation.	Second generation.	Third generation.	Fourth generation.	Fifth generation.	Total.
Total number of persons :						
Male ...	103	304	48	9	1	465
Female ...	203	244	47	11	..	505
Feeble-minded .						
Male ...	84	199	25	7	1	316
Female ...	164	157	31	6	..	358
Insane :						
Male ...	5	4	..	..	..	9
Female ...	17	5	..	..	..	22
Epileptic :						
Male ...	1	2	1	..	..	4
Female ...	1	1	..	..	..	2
Deaf :						
Male ...	..	..	..	..	..	..
Female ...	..	1	..	..	..	1
Blind :						
Male ...	3	2	..	..	..	5
Female ...	1	..	..	..	..	1
Feeble-minded and deaf :						
Male ...	..	..	..	..	..	..
Female ...	1	3	..	..	..	4
Feeble-minded and epileptic :						
Male ...	..	8	2	..	..	10
Female ...	3	11	..	..	..	14
Feeble-minded and paralytic :						
Male ...	1	..	..	..	..	1
Female ...	3	1	..	..	..	4
Feeble-minded and blind :						
Male ...	3	..	..	..	..	3
Female ...	6	3	1	..	..	10
Feeble-minded, blind and epileptic :						
Male ...	..	..	..	..	..	..
Female ...	..	1	..	..	..	1
Feeble-minded, paralytic and epileptic :						
Male ...	..	1	..	..	..	1
Female ...	1	1	..	..	..	2
Feeble-minded, deaf and epileptic :						
Male ...	..	1	..	..	..	1
Female ...	1	..	..	..	..	1

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	First generation.	Second generation.	Third generation.	Fourth generation.	Fifth generation.	Total.
Paralytic :						
Male	1	..	..	..	..	1
Female	..	..	..	..	..	..
Insane and epileptic :						
Male	..	..	..	..	..	..
Female	1	..	..	..	..	1
Insane and deaf :						
Male	..	..	..	..	..	..
Female	..	1	..	..	..	1
Unknown or normal :						
Male	5	87	20	2	..	114
Female	4	59	15	5	..	83
Illegitimate :						
Male	..	46	15	1	1	63
Female	3	26	15	..	..	44

Parents of third generation	26
" " fourth "	7
" " fifth "	1

according to the records in our office, has been in the poor asylum over twenty years, was the mother of two daughters, to whom she transmitted her mental defect. One of these feeble-minded daughters, Rachel, has been twice married, and has borne eleven children, three of whom are now dead. Her second union was with a negro. Her children are very ignorant, but so far our records do not show that they have been inmates of any public institution, with the exception of one son, who has been in prison. The other daughter, Kate, had four children, all girls, two feeble-minded and two illegitimate. The two feeble-minded daughters have spent much of their lives in the county poor asylum. One of them, Nancy, became the third wife of a feeble-minded, paralytic man, and one son and three feeble-minded daughters were born to her. Her husband's second wife had a feeble-minded daughter, who married an insane man, and they have one child, a son. Nancy's feeble-minded sister, Lou, married a feeble-minded man, and three daughters and two sons have been the result of this marriage. One of the daughters is feeble-minded. One of the sons, also feeble-minded, is a natural criminal. The direct descendants of the feeble-minded woman first mentioned number

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twenty-nine, and in the past ten years twelve of these persons have spent an aggregate of twenty-two years in the poor asylum and orphans' home of the county. The total family members reported number forty-seven and extend over five generations.

A RECORD OF THIRTEEN FAMILIES OF THREE GENERATIONS EACH.

	First generation.	Second generation.[1]	Third generation.
Number of persons:			
Male	7	7	14
Female	11	19	10
Feeble-minded:			
Male	6	6	..
Female	9	14	..
Insane:			
Male	..	..	..
Female	1	..	..
Feeble-minded and epileptic:			
Male	1	..	..
Female	1	..	..
Feeble-minded and deaf:			
Male	..	..	..
Female	..	1	..
Deaf and dumb:			
Male	..	..	..
Female	..	2	..
Unknown or normal:			
Male	..	1	14
Female	..	2	10
Illegitimate:			
Male	..	..	5
Female	..	2	6

One group of 13 feeble-minded families is recorded containing 68 individuals. Of these there were 18 in the first generation; 26 in the second; 24 in the third. With these degenerates it is not always true that when there is a little child there are three persons in a family. The paternity is not always known and in many cases we are compelled to count two persons, the mother and child. All the members of the first generation were feeble-minded; twenty of the second generation showed the same defect. The mental condition of the third generation is not given. The reason is that they were reported when they were at an age at which it could not be determined. Eleven of its members, however, are reported as illegitimate. The 11

[1] Number of persons in second generation who had children = 12.

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women in the first generation were the mothers of 26 children. The 24 members of the third generation are the children of 12 of these. It will be noted that when the younger members of a generation are born in an institution, or become inmates very young, their mental condition cannot be reported and often is not known unless they are readmitted when they become older and the psychosis can be determined. Neither the husbands nor the wives of the members of this group are counted in this table. Those enumerated are the direct descendants of the persons in the preceding generation.

It is not unusual to find in a poor asylum three generations of feeble-mindedness. Not long since, the speaker had grouped before him, at a poor asylum in the southern part of the State, four generations of feeble-minded persons—father born in 1817, daughter, granddaughter, and great-grandson. There are nineteen members of this family; nine are feeble-minded and four are illegitimate. Most of them have been inmates of the institution where they were seen. Some of them recur to it from time to time yet. This is not a single instance, for in other poor asylums an equal number of generations, similarly afflicted, can be found, and in fact there are nstances where five generations have at one time or another been inmates of such a county institution.

Years and years ago a single man here and there—a prophet in a strange land—began to call attention to the condition of the idiot. They were treated as animals in confinement. At the beginning of the present century the first institution was built for their care.

Dr. Walter E. Fernald tells us that the first recorded attempt to educate an idiot was made about the year 1800 by Itard, the celebrated physician-in-chief to the national Institution for the Deaf and Dumb at Paris, upon a boy found wild in a forest in the center of France, and known as the 'Savage of Aveyron.' This boy could not speak any human tongue, and was devoid of all understanding and knowledge. Believing him to be a savage, for five years Itard endeavored with great skill and perseverance to develop at the same time the intelligence of his pupil and the theories of the materialistic school of philosophy.

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Itard finally became convinced that this boy was an idiot, and abandoned the attempt to educate him. (Proc. Nat. Conf. Char. and Cor., 1893, page 203.)

In 1818 the American Asylum for the Deaf and Dumb, at Hartford, Conn., the first institution of its kind in this country, gave the first instruction offered in the United States to idiotic children. Following this several attempts were made in teaching such children in France, Switzerland and Germany. But a few could be cared for. Slowly the thought of the possibility of their improvement spread. The progress of the work was slow. Individuals were interested and pressed into it. Finally a State took some interest.

In 1846 the first effort was made for legal provision for the instruction of idiots in this country in New York. This was unsuccessful; but a few days later in the same year action looking to similar results was begun in Massachusetts. This culminated in legislation in 1848, providing for the education of 'ten indigent idiots.' Thus began our public institutions for idiotic or feeble-minded children. In New York efforts providing for such a school were repeatedly made, but it was not until 1851 that they were entirely successful and the act passed in that State. Pennsylvania was the third State to begin the work in 1852. It was followed by Ohio in 1857. One after another of our States has recognized the duty of providing education, training and care for these unfortunates. In a number of States institutions of the highest standing have been developed. Dr. Fernald tells us the early history of these pioneer State institutions in many respects was very similar. They were practically all begun as tentative experiments in the face of great public distrust and doubt as to the value of the results to be obtained.

At last it became recognized that those who had given years of study to the idiot had a right to have an opinion and to express it. Then it came to be believed and advocated that in this class of defectives were many who were amenable to instruction if it were only of the right kind and taught in the right way. The children might be reached and helped.

First it was thought that many of these children could be

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educated to make their own way in the world. Finally it was decided that while many of them could be taught to be self-supporting under direction, but very few could ever leave the fostering care of the institution. Children they are and children they will be as long as they live. For, though they become old in years, mentally they will still be children.

More and more came the conviction that there should be custodial institutions. These were especially advocated for feeble-minded women under forty-five years of age. They would be safe and with no prospect of reproducing their kind. Now it has come to be regarded as the proper right and duty to retain control over these grown-up children during life. Some States have made a beginning for this purpose.

Never did we appreciate so strongly as we do to-day the untold misery and accumulating expense caused by the lack of control of our feeble-minded population. Their fecundity and animal instincts make them fit subjects for consideration, both on financial and moral grounds, to say nothing of the dangers that beset those of strong minds who have weaker bodies.

The problem presented to us is the manner in which these conditions shall be met. Its solution lies in an intelligent and general knowledge of the subject by the public, preventive measures by legal marriage restrictions and other means, the education of feeble-minded children and the custodial care of feeble-minded women.

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SOCIAL AND ECONOMIC SCIENCE.

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ADDRESS

BY

CALVIN M. WOODWARD,

VICE-PRESIDENT AND CHAIRMAN OF SECTION I, FOR 1900.

THE CHANGE OF FRONT IN EDUCATION.

Dr. Samuel Johnson considered education as needful to the 'embellishments of life.' In his day very few were educated at all, and those few for society or public service. The toiling masses had no education, were supposed to need no education, and while discussing details educators and scholars took no thought of what we call the common people.

Said Johnson (in his 'Life of Milton'):

"The truth is, that a knowledge of external nature, and the sciences which that knowledge requires or includes, are not the great or the frequent business of the human mind. Whether we provide for action or conversation, whether we wish to be useful or pleasing, the first requisite is the religious and moral knowledge of right and wrong; the next is an acquaintance with the history of mankind, and with those examples which may be said to embody truth, and prove by events the reasonableness of opinions. Prudence and justice are virtues and excellences of all times and of all places. We are perpetually moralists, but we are geometricians only by chance. Our intercourse with intellectual nature is necessary; our speculations upon matter are voluntary and at leisure. Physiological learning [by which he means a knowledge of the laws and phenomena of the external world] is of such rare emergency, that one may know another half his life without being able to estimate his skill in hydrostatics or astronomy; but his moral and prudential character immediately appears.

"Those authors, therefore, are to be read at schools that sup-

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ply most axioms of prudence, most principles of moral truth, and most materials for conversation; and those purposes are best served by poets, orators and historians."

This statement was, no doubt, entirely adequate to the demands of Johnson's time. Polite conversation and elegant manners were the chief characteristics of an age in which Chesterfield was a bright and shining light. With the dull, hard-working, unlettered crowds, that plodded on in the steps of their grandfathers, educators had nothing to do; for such they had no educational theories.

How wonderfully conditions have changed, both as to the curriculum and as to the constituency of education. It is interesting to picture, in fancy, the bewilderment of a Sam Johnson in the learned circles of this scientific and industrial age. Imagine him attempting to join in the discussions of our British and American Associations for the Advancement of Science, in our educational conferences, or in the halls of exchange, where the active minds of our generation do mostly congregate. He would find it difficult, in spite of the wonderful vigor of his intellect, to be either useful or ornamental, though he could easily be amusing.

From the days of John Milton, in 1608, to the end of the eighteenth century, university training culminated in a preparation for the professions of law, medicine and theology, and in the training of the nobility for the duties and responsibilities of government and elegant society.

But when alchemy developed into chemistry; when physics became an experimental science; when Leibnitz and Newton elaborated the infinitesimal calculus; when Watts invented an efficient steam engine; when Fulton built a successful steamboat; when Stephenson devised the locomotive and constructed a road with smooth rails; and finally when Siemens and Gramme produced the electric motor, vast fields of fascinating and useful material were opened for study and research. Mathematical analysis and the principles of mechanics, which had previously been devoted to the problems of physical astronomy, were now directed to the study of the transformation and transmission of energy, the theory of structures, and the phe-

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nomena of electricity. The theory of evolution gave a new meaning to all vital phenomena; and the doctrine of the conservation of energy permeated all study of motion and force.

In the earlier days, Alexander Pope voiced the popular notion that 'the proper study of mankind is man.' 'Nature Study,' which to-day is the bright, attractive feature of the primary school, and equally the inspiring field of the savant, was not countenanced by polite society. For centuries it was held to be little short of blasphemy to wound the earth by digging for ores which were intended to be hidden away from our sight and touch, or to attempt in any way to improve upon God's workmanship. When in 1680 a Spanish engineer proposed to deepen the channels of certain rivers and to restrain their overflows in the interest of navigation, the Spanish Council decreed as follows: "If it had pleased God that those rivers should have been navigable, He would not have needed human assistance to make them so; but as He has not done it, it is plain that He does not want it done"; and the improvements were forbidden. This decree reminds me of a bit of Mrs. Eddy's logic which you may remember in substance as follows: Had the Almighty intended that drugs should be used in treating sick people, He would have placed drugs in the hands of Jesus and his disciples; Jesus and his disciples used no drugs; it is therefore evident that the Almighty does not wish drugs to be used upon people who are sick.

But, putting aside pseudo-science, the modern thought of the creation is that it was and is a part of the all-wise plan to fill the earth with unsolved problems, the study and solution of which should develop our best powers, and at the same time cultivate our highest instincts of reverence for the Creator and of love and devotion for His creatures.

It has taken many centuries for the world to discover that the great forces of nature are neither sacred nor profane, neither kind nor cruel, that they neither love nor hate, and that they are more unchangeable than the stars; that shrines and temples, priests and priestesses, tripods and oracles, have been in vain, except so far as they reacted upon the human heart and satisfied its natural craving for the worship of the Superior

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Being. Instead of building a temple to the far-darting Apollo or to Zeus, the Thunderer, we now stretch over our cities a network for artificial lighting; and all the winds that blow and all the waters that flow are made to furnish their tribute to our comfort and pleasure. We tap the sources of endless energy and transmit it through all the ramifications of our social order, relieving mankind from heavy burdens and creating hundreds of occupations hitherto unknown.

Out of this vast extension of the horizon of human activities, and a corresponding multiplication of occupations, has come an imperative demand for more education and for technically educated men. In our industrial system the crying want has been and is for men who can both plan and execute. The secret of our unparalleled commercial and industrial success lies in the fact that we have put educated brains into our work. Hence a score of professions unthought of 100 years ago have been called into being, and the standards of these new professions are of the highest order.

It is this grand movement towards a study of the materials and the forces of nature and the problems of modern life, sociological, commercial and industrial, that constitutes the change of front in education. This does not mean that we must abandon altogether the old education. We must preserve all that is permanently fine and essential to high thinking and well doing. The great epics of Homer, like the book of Job and the Psalms of David, will live forever, imperishable monuments of the youth of the world, but we shall not perpetually care for Aristotle's speculations about the origin of matter, or the conceited discussions of Cicero at Tusculum. Modern life in all its details has so far departed from the ancients that neither their moralizings nor their tragedies have a lively and sustained interest for us. We are deeply interested in the affairs of to-day, in a civilization not based upon human slavery, nor upon a blooded aristocracy buttressed and supported by millions of laborers ground down in ignorance, poverty and superstition, but based upon the principle of human equality before the law, and of equal rights to life, liberty and the pursuit of happiness.

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In turning from an inherited scheme of education which faced backward, which concerned itself largely with the thoughts, the deeds and the theories of the past, and in proclaiming the universal need, as well as the universal opportunity, of education, we must not fail to preserve the dignity and the nobility of our educational standards. In spite of frequent assumptions to the contrary, modern education is becoming more and more 'liberal.' The defenders of the Johnsonian programs delight in the use of unworthy epithets with which to characterize the tendency of modern education; they plead for 'humanities' as though anything human was foreign to our curriculum. What can be more human than human life as we see it and as we share in it? What problems can be more human than those which face nine out of ten of the people who reach the age of individual responsibility?

More and more we are considering the many and not the few, when we draw up our schemes of study and training. As wealth increases, as the hours of labor become shorter, as luxuries multiply, and a taste for literature and art and science becomes general, the number of students entering upon some form of higher education greatly increases. The number of such students to-day per million of people has doubled several times in fifty years.

It is, therefore, not surprising that there should arise, in the minds of many less familiar with the content and the method of a modern technical university, a fear that both the standards of character and the standards of scholarship should suffer, and, in being less 'select,' that the content of education should at the same time be less fine. Whether this fear be well grounded or not, we must all sympathize with its spirit. We can have no quarrel with those who wish the first fruit of education to be character. I cannot forbear quoting a few sentences from the late president of the Massachusetts Institute of Technology, Gen. Francis A. Walker, upon the tendencies of modern technical education, in reply to certain strictures as to its dignity and unselfishness. In his remarks at the dedication of the new science and engineering buildings at McGill University, Montreal, General Walker said:

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"The notion that scientific work was something essentially less fine and high and noble than the pursuit of rhetoric and philosophy, Latin and Greek, was deeply seated in the minds of the leading educators of America a generation ago. And it has not even yet wholly yielded to the demonstration offered by the admirable effects of the new education in training up young men to be as modest and earnest, as sincere, manly and pure, as broad and appreciative, as were the best products of the classical culture, and, withal, more exact and resolute and strong. We can hardly hope to see that inveterate prepossession altogether disappear from the minds of those who have entertained it. Probably these good men will have to be buried with more or less of their prejudices still wrapped about them, but from the new generation scientific and technical studies will encounter no such obstruction, will suffer no such disparagement.

"Another objection which the new education has encountered is entitled to far more of consideration. This has arisen from the sincere conviction of many distinguished and earnest educators that the pursuit of science, especially where its technical applications are brought strongly out, loses much of that disinterestedness which they claim, and rightly claim, is of the very essence of education. I differ from these honorable gentlemen. I believe that the contemplated uses of science, whether in advancing the condition of mankind, or even in promoting the ulterior usefulness, success and pecuniary profit of the student of a technical profession, do not necessarily impair that disinterestedness. These gentlemen appear to me to have an altogether unnecessary fear of the usefulness of science.

"The strong desire to become a useful man, well equipped for life, capable of doing good work, respected and entitled to respect, constitutes no breach of disinterestedness in any sense of that word."

Finally he says:

"I boldly challenge comparison between the scientific men of America, as a body, and its literary men or even its artists, in the respect of its devotion to truth, of simple confidence in the

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right, of delight in good work for good work's sake, of indisposition to coin name and fame into money, of unwillingness to use one thing that is well done as a means of passing off upon the public three or four things that are ill done. I know the scientific men of America well, and I entertain a profound conviction that as regards sincerity, simplicity, fidelity and generosity of character, in nobility of aims and earnestness of effort, in everything which should be involved in the conception of disinterestedness, they are surpassed, if indeed they are approached, by no other body of men."

Of like import are these words from a recent address of Hon. F. W. Lehmann, of St. Louis. Speaking of the breadth of the modern university, he said:

"The university of to-day has abdicated none of its old functions, but it has taken on many new. Not disdaining mere scholarship, making, indeed, the standard always a higher one, it widens its domain and adapts its teachings to the after-work of life. Its graduates are not simply conventionally finished gentlemen, but beginners in the serious business of life, scholars as before, but artists, engineers and artisans as well. The sciences lose nothing because they become utilities. Physics and mathematics gain in interest by application to the building of bridges, and the very sewers of a city become classic to the scholar because one of the means to the classic excellence of a sound mind in a sound body."

Perhaps the characteristic most dreaded by the opponents of the new education is usefulness. They have but to learn that a certain branch of study, course of training or line of culture is useful, and its value is at once compromised. One of the few foolish things that Lowell ever wrote or said was that 'a university is a place where nothing useful is taught.' I will not discuss a statement which, after all, may not do justice to Lowell's thought, but I will define a university as a place where everything useful in a high and broad sense may be taught. Matthew Arnold would have defined a university as a place where is taught and illustrated 'the best that has been thought and done in the world.'

Supt. Gilbert, of Rochester, N. Y., said at Buffaio last

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month: "The exalted character of a man's work is to be measured by its usefulness to mankind; I believe in the universality of service."

It has often been assumed that this new education is not liberal. Liberality consists not so much in the subject as in the method of study. The liberal method is broad, deep, generous, comprehensive. It recognizes infinite uses, both far and near. It aims at the artist rather than the artisan; the engineer, not the craftsman; the free man not the slave. Liberal culture deals with fundamental principles, typical phenomena, general results, not special applications. It is liberal to study the laws of manufacture, trades, commerce, finance and social progress; it is not liberal to seek merely the conditions of a successful business, whether it be law, medicine or manufacture. It is liberal to demand the *raison d'etre* of dogma, canon, rule, dictum, formula or usage; it is illiberal to blindly follow authority, to put facts and processes above principles and reasons, to prefer echoes to living voices.

A recent reviewer said that mathematics and electricity are becoming less valuable for general education on account of their increasing usefulness in technical pursuits. The maximum of educational value (he held) appertains to a sort of knowledge which falls short of such a mastery as makes it useful. Of course, I accept no such statements. That man's notion of a liberal education is not yours nor mine.

The list of liberal branches of study is ever increasing. For four years Harvard compelled me to give one-sixth of my time to Greek and one-fourth to Latin; to-day one may go through Harvard and take his degree without giving one moment to either Greek or Latin, while in Cambridge. The same thing is true at many universities. Are we, therefore, less liberal than formerly? Can we not answer that we are more liberal? People now read Demosthenes and Quintilian and Horace, analytic geometry, physics, thermodynamics and the like, because they wish to be familiar with those authors or to master those subjects, not because they are compelled by a traditional canon. Does any one suppose that there is not a decided gain in the quality of the result?

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Through the technical schools, some of the most valuable educational studes have been developed. How few people realize the surpassing mental discipline that comes from the study of descriptive geometry, laboratory physics and the mechanic arts. I knew nothing of the study of descriptive geometry till years after I left college, and yet no subject I had in college could compare with it as a mental stimulus and a cultivator of the scientific imagination. It ought to have place in every liberal course of study. Modern courses of study contain, of necessity, extensive allowances of laboratory work of one sort and another. Our idea of all such work is that the method shall be unfailingly rational; that facts, though essential, shall be rated as far less important than the principles which underlie them. Where this idea is realized, the study becomes truly liberal.

In spite of the old claim of preeminent liberality, the old college curriculum, when examined historically, is found to have been adopted for reasons of utility. People learned Latin because they wanted to use Latin. All books and state papers were written in Latin, and one needed to both read it and write it, as we must English prose. The physician must read Galen in the original; the clergyman needed the Greek Testament; the lawyers must read the Institutes of Justinian, and the man of leisure and the orator must be able to quote Aristotle and Homer, Virgil and Horace. The first American colleges were organized for the training of clergymen. Every feature of the course was directly useful to the end in view.

It is easy to see the source of a wide-spread prejudice against technical training. The history of civilization has been the history of masters and slaves, of castes, of contempt for labor and for all useful arts. Everyone of the technical professions had its beginning in the crafts and the present technical expert and engineer had as a prototype a man in overalls, with horny hands and a soiled face, who presided over some enginery which was not authorized by the ancients and which at best was generally regarded as ungenteel. Milton placed Memnon, the first ante-tellurian engineer, among the fallen angels, and sent him

'With his industrious crew to build in hell.'

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The engineer is by nature an iconoclast. He has small respect for the traditions. He bows not down to the 'tyranny of the ancients.' His glories are in the future. He looks forward, not back. He does not hesitate to smile at the puerile fancies of people who created gods and demi-gods in order to account for phenomena which to-day submit to mathmatical analysis and which bear no comparison with the exploits of modern engineering. The accomplished engineer generally reciprocates the prejudice I have mentioned, for he cannot understand how the worship of the ancients can be really serious; it seems to him three-fourths affectation. This mutual prejudice was fostered by the high wall of separation which at first kept the technical and the historical branches of study far apart. That wall, I am happy to say, is fast tumbling down, and men are rapidly scrambling over it in both directions. It becomes us, from our various vantage grounds of influence, to encourage this evolution of a better feeling, a more intimate acquaintance, a mutual respect, and a common zeal for whatever is broad and high and fine.

While we may for many reasons congratulate ourselves on the decided change of front we have achieved in education, we must not be blind to the fact that much remains to be done. We must still devise a scheme of secondary and higher education for a stage of progress in which secondary and higher education may become approximately universal. As Sir Walter Besant put it, "the twentieth century must not only open up all intellectual careers to lads [and lasses] who are capable, clever and ambitious, but we must have a system of education broad enough and elastic enough to include the children who are destined for crafts, industries and arts of all kinds; one that will make them good citizens, not ignorant of their civic rights, and alive to their civic duties."

I do not at all assume that we have yet discovered the true system for universal secondary education. The manual-training high school with its opportunities for training and culture along many lines, industrial, commercial, civic, artistic and literary, seems to come near the ideal, but it is by no means

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generally accepted, and when accepted it is at once exposed to serious dangers.

In our most advanced communities only a small minority of children enter upon the secondary stage of education. In my own city of St. Louis, only about one boy in seven takes a course in a school of high-school grade. In many communities the proportion in secondary schools is greater—in others it is less. There must be some reason for this; either the training and culture are not what they ought to be, or our people are so ignorant that they do not know the value of education. I will not admit that poverty offers a sufficient explanation. In either case, it is evident that we have much to do and much to learn.

Of the dangers to which the manual-training high school is exposed, I have spoken elsewhere at length.[1] I will at present only refer to the strong tendencies of 'practical' people, who are more intimate with the old system of apprenticeship than they are with the art of education, to introduce the teaching of special trades. I think we shall be able to stem this unfortunate tendency, but it is well to be forewarned that we may be forearmed. The advocates of the introduction of trade work make three serious mistakes:

1. They assume that the graduate of the manual-training school is unfitted to enter an industrial shop to advantage.

2. They would begin trade work with pupils who are too young.

3. They do not realize that only about 50 boys in 100 are so constructed mentally and physically that they can and ought to learn what are known as the industrial trades

In my paper already referred to, I have at some length defended the natural right of a boy to the privilege of choice of occupation at an age of some maturity and after a training which enables him to substitute a rational judgment for a boyish whim.

In this connection, I fail to endorse at least one feature in the Report of the Advisory Committee of the Carnegie Technical School. The full report was published in *Science* for July 12, 1901. For a variety of excellent reasons, the Com-

[1] Read before the Labor Commissioners of the several states in 1891, and printed in Commissioner Wright's Report for 1901.

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mittee reaches the conclusion 'that some new kind of preparation for the work of life must be introduced into the school training of both boys and girls.' It then proceeds to outline a technical college, a technical high school and an artisan day and evening school, which are to meet this demand. Here we have a clear recognition of a twentieth-century problem and an attempt to solve it.

The artisan day and evening school is somewhat on the order of German and English low-grade technical schools. I earnestly hope that the suggestion of this school may be adopted and that the experiment may be fairly tried in America. The plan for a technical college is in complete harmony with our best engineering schools, and needs no discussion here.

The scheme for a technical high school, however, seems to me faulty. This school would be of high-school grade, taking pupils from the grammer schools and covering presumably four years. The normal ages of entrance and graduation would accordingly be 14 and 18.

Three things in the Committee's outline of this technical high school deserve more attention than I can give them at this time:

1. The elective principle is to be recognized, the student selecting the required number of courses under the direction of the director of the school. Here the pupil at a tender age (only 14 or 15) is asked to surrender his birthright to the privilege of a choice which he ought to make at the age of 18.

2. The course in mathematics—which begins with elementary algebra—is to include the *elements of calculus!* Of course, it must include solid geometry, higher algebra, trigonometry and analytical geometry! One rarely meets with such an astounding proposition from engineers who are supposed to have studied mathematics and to know what they are talking about. They might as well propose that the pupils shall take thermodynamics in a short course of lectures. To be sure, similar ambitious schemes have been proposed elsewhere for boys just out of the grammer school, but they came from people who could have known very little mathematics, and nothing of

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the uses of the calculus. This criticism may seem trivial, but in more than one place the scheme atempts too much.

3. The technical studies suggested take the form of trade work or special employments, with well-equipped shops and experimental laboratories under the direction of expert artisans.

What Mr. Carnegie will do with this last suggestion remains to be seen, but any attempt to embody it in a real technical high school of secondary grade will be full of interest to the educational world. If any man was well prepared to give the scheme a fair trial that man is Andrew Carnegie; but it will cost a vast amount of money and its experience will teach us how not to do many things.

I have high respect for the members of the Advisory Committee, but I think a less ambitious scheme would be more successful. You cannot teach the higher mathematics in a high school, and I have no great faith in the value of attempts to teach employments, commercial or industrial, within the limits of any secondary school. Such attempts are certain to mislead and ultimately hinder those they aim to help. Any trade or special employment must be dwarfed and narrowed before it can be brought down to the grasp of an untrained boy, and its very narrowness unfits it for the best educational uses.

The school is the place where one should learn the fundamental unchanging laws and manifestations of force and materials. Special occupations, like special constructions, should be analyzed into their elements, and pupils should become expert in such analyses, in so far as they involve universal elements that pupils can comprehend. But there are many things essential to a business employment which cannot even be apprehended in school. As William Mather, M.P., says:

"There is no possibility of teaching in a school that sort of knowledge which practical work carried out on commercial principles, within restrictions as to time of execution, etc., can alone make any one familiar with." ('Technical Education in Russia,' p. 12.)

As to values, let us teach intrinsic values, not market values;

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the latter are fluctuating with time and place, the former are permanent.

No scheme of American education is complete without a careful study of the duties and responsibilities of citizenship. The tramp, like the political leech, assumes that the world owes him a living; the good citizen knows that he owes it to the state to earn his own living, to support his family and to contribute his share to the necessary expenses of the city, state and nation. Hence the youth must learn how the city, state and nation are respectively organized and what their proper functions are; and when he is a man he must to the extent of his ability see to it that those functions are placed in the hands of public servants who are both capable and honest. The corrupting influence of a politician who fosters selfishness in his neighborhood that he and his neighbors may profit at the expense of other neighborhoods, must be counteracted by a generous education which shall cultivate a love of justice and plant the seeds of manly and noble ideals. If democratic governments are to survive, the whole people must be educated to the highest standards of citizenship, and the new education must face and solve the problem of securing those results.

READ IN DENVER, AUGUST, 1901.

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PAPERS READ.

THE CENSUS OF CUBA. BY VICTOR H. OLMSTEAD, Assistant Director of Census of Cuba.

DANGERS FROM INACCURACY IN PRESENTATION OF TRANSPORTATION PROBLEMS. BY JAMES H. BLODGETT, U. S. Department of Agriculture.

FARM OWNERSHIP AND TENANCY IN DELAWARE. A STUDY OF FARM TENANCY. BY LE GRAND POWERS, U. S. Census.

WHAT NEXT—IS IT SOCIALISM? BY WALTER S. LOGAN, New York City.

SCIENTIFIC MEN OF COLORADO. BY MARCUS BENJAMIN, U. .S National Museum.

[Published in Columbian Quarterly.]

THE DEVELOPMENT OF THE MINERAL RESOURCES OF COLORADO. BY CHARLES W. COMSTOCK, Colorado School of Mines.

THE SOIL AS A SOCIAL AND ECONOMIC FACTOR. BY FRANK K. CAMERON, U. S. Department of Agriculture.

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ECONOMIC WORK OF THE U. S. GEOLOGICAL SURVEY. By L. F. SCHMECKEBIER, U. S. Geological Survey.

THE WORLD'S BREAD SUPPLY. By EDWARD T. PETERS, U. S. Department of Agriculture.

THE ECONOMIC SIDE OF ENTOMOLOGY. By L. O. HOWARD, U. S. Department of Agriculture.

WOMAN'S SUFFRAGE IN COLORADO. By J. E. LE ROSSIGNOL, University of Denver.

THE SINGLE TAX. By JAMES CROSBY, Denver, Colo.

THE ROAD PROBLEM. By JAMES W. ABBOTT, Denver, Colo.

LEASING AND DISPOSAL OF THE PUBLIC LANDS. By C. E. WANTLAND, Denver, Colo.

PROTECTION OF COMMUNITIES BY THE FORESTS. By GIFFORD PINCHOT, U. S. Department of Agriculture.

MECHANICAL TABULATION OF THE STATISTICS OF AGRICULTURE IN THE TWELFTH CENSUS OF THE UNITED STATES. By H. T. NEWCOMB, Editor of the Railway World.

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THE INTERDEPENDENCE OF THE SCIENCES. BY MAX WEST, U. S. Industrial Commission.
[Published in Science.]

THE PRESENT STATUS OF COMMERCE IN THE EDUCATIONAL POLICY AND IN THE ADMINISTRATIVE ORGANIZATION OF MODERN NATIONS. BY JOHN FRANKLIN CROWELL, U. S. Treasury Department.

IRRIGATION. BY F. H. NEWELL, U. S. Geological Survey.

THE SCOPE OF NATIONAL AID FOR IRRIGATION. BY FRED. BOND, Cheyenne, Wyo.

THE GRAND CANYON, OF THE GUNNISON. BY A. L. FELLOWS, U. S. Geological Survey.

THE DEVELOPMENT OF IRRIGATION IN COLORADO. BY L. G. CARPENTER, Colorado Experiment Station.

THE SOCIAL AND ECONOMIC ASPECTS OF IRRIGATION. BY GEORGE H. MAXWELL, Washington, D. C.

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SECTION K.

Physiology and Experimental Medicine.

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OFFICERS OF SECTION K.

Vice-President and Chairman of the Section.

W. H. WELCH, Baltimore, Md.

Secretary.

F. S. LEE, New York, N. Y.

Member of Council.

J. McK. CATTELL.

Sectional Committee.

C. S. MINOT, R. H. CHITTENDEN, D. S. LAMB.

Member of General Committee.

A. M. BLEILE.

[Section K was organized at the Denver meeting but no papers were read.]

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EXECUTIVE PROCEEDINGS.

REPORT OF THE GENERAL SECRETARY.

The first general session of the Denver meeting was called to order in the auditorium of the High School Building at 10 o'clock in the morning of August 26 by the retiring president of the Association, Professor R. S. Woodward, of Columbia University, who introduced the president-elect, Professor Charles S. Minot, of Harvard University. President Minot introduced the Hon. J. B. Grant, president of the local committee, who, after some remarks welcoming the Association to Denver and to Colorado and the reading of a letter from the Governor of the State, introduced the Hon. R. R. Wright, Jr., Mayor of Denver; Mr. Charles F. Wilson, President of the Chamber of Commerce; General Irving Hale and Professor Aaron Gove, Superintendent of Schools, all of whom made addresses of welcome.

To these addresses President MINOT replied as follows:

I was impressed on my way here with the somewhat unexpected arrangements I found for securing my services as a visitor at Denver. We found it easy to get here because we paid for a night's journey upon the road and owing to the delay of the train we got two nights' journey instead of one, showing how attractive it is here and how liberally one is treated coming to Denver. But when I went to your ticket office to inquire about going away I found we had to pay the price of two nights in order to pass one when leaving your city. So there seems to be every inducement to prolong our stay. I could not but think, as I read in the newspaper that this Association had fallen upon Denver, of an anecdote related to me a few days ago in the Yellowstone, when I was told a German visitor had been there and seen the geysers, and afterwards had gone to Niagara. When asked how he liked it he said, "Oh, dat is very fine, but you shall see the geysers, they fall oop." That is the way we have 'fallen upon' Denver. We are all wonderfully impressed by the extraordinary endowments of nature in this state. It is almost incredible to a visitor coming here for the first time that any tract of land should be so richly provided with all the raw resources which man needs for the construction of civilization. We, like you, are laboring in this process of building up civilization. As you have

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been working in your state, so we work in every territory of nature seeking to bring forth her hidden treasures and render them available for the service of mankind and for establishing a higher life in humanity than has yet been. It is not so in the east with us at home. There civilization has been going on longer. The resources which nature provides are known. The work of civilization proceeds there in established channels, and I felt at once in coming here that the newness and creative character of your work in Colorado made a sympathetic atmosphere for us who are striving to create what is new and get from nature her unused treasures which we can employ hereafter. Everything therefore speaks of sympathy and understanding between the practical life of Colorado and the scientific life of this Association. And we are, too, nearly contemporaries. The Association was before Denver was, but not by many years. We have, as it were, grown up together and have lived through the same period of our country's history. Therein, too, lies the power of appreciation—mutual, I believe—between you and us who are here playing a double role of both guests and, in our meetings, of your hosts—for hosts we would gladly be, inviting you to our meetings, for we are a kind of intellectual Salvation Army. We do not profess to do much for the saving of souls as our direct work, though we believe that all good work tends to that end, but we do believe that we can do a great deal to save brains, they being the only things in nature which in being used are best saved and made better. So if we stimulate you to use your brains more we shall have done some service, we shall have done something to save your intellectual life, to broaden it and make character. If as a biologist I survey the realm of nature and seek to make out what is the distinguishing characteristic of man, I have to recognize that it is the value of the individual which distinguishes the human species from every other living species in the world. Man alone is able to profit by the superiority of the individual members of his species. Animals may learn a little from one another. Man alone can learn much. It is owing to this peculiarity in nature of the human species that science exists, that civilization exists, and I believe the recognition of that fact should have a profound influence upon all our political and social questions whenever we have in mind the promotion of human welfare; because, it being a true fact in nature that the average civilization of a community is not correspondent to the average intellectual and moral calibre of its members, but very nearly to the intellectual and moral calibre of its best members, that fact imposes upon us a special duty, that of promoting the development and the education of the best members in the community. And if I were asked to say what in the west seemed to me the very best thing you had to show, I should say without a moment's hesitation it is the high school buildings here and the high school buildings we have seen in the other cities as we have passed along—emblems, as they are, of the educational system which in

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the very establishment of its high schools recognizes the fact that there are superior individuals who are worthy a better education than is offered by primary and grammar schools below.

But it does not do to stop there. And I am glad to see that the State of Colorado has started already the development of a university which by its prosperity shows the earnestness with which it has been founded, the devotion which has been spent upon fostering it and which stands as one of the highest marks to the credit of the State. I believe that the very best that we could do for you would be to contribute something to the public recognition of the value of the State University. It seems to me that no citizen of Colorado who has the highest ideal for the future of the state can feel that the state has done its full duty until it has developed its university, not only as it has begun, but farther in the same direction, until it shall have become one of the great universities of the country—I would even say one of the great universities of the world. It is not enough for you to work here for the development of your material resources. It is not enough for you to apply science. We who are carrying on our investigations supply the power, we generate the steam pressure, and the practical man—if I may be pardoned for the inuendo—is the crank which transmits the power to a practical purpose. Unless a state is doing its quota towards the increase of knowledge, it is fulfilling only a part of its duty. If, therefore, our coming here can have such an influence upon any of you as to increase the belief in the value of your university and to spread that belief among you making it deeper rooted in the innermost convictions of your great community that the university is the greatest thing in the state, we shall have done a service to you which will show we are grateful for all the magnificent hospitality which has been proffered us, for the perfection of the arrangements made here for our comfort, and that we appreciate your words of welcome, those which have come to us from the Governor, from the Mayor of the city, from the representatives of the business interests of your community and of your educational system. All this we take to heart and we beg to thank you for it with all the sincerity with which we appreciate it. And in return we would offer you this thought which is the inspiration of the professor—that the country is governed by universities, because what is done in the country is done by the men who think, who come out into the world with thoughts which were never there before; and the men who do that, with very rare exceptions, are men who have had their minds severely disciplined by university training. If you look back through the history of the United States and recall men who as statesmen, as inventors, as authors, were creators of any kind of new intellectual product, you will find that there is but a trifling number among those great men who have not come from the universities. And, therefore, it is true as a historical fact that this country is governed by the universities, and there is not a complete

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government in any state, in the opinion of the members of this Association—I am sure in the opinion of all of them—until there is a great, well-equipped, richly endowed and largely attended university. It is therefore to me the greatest pleasure to see that Colorado has begun with this ambition, and I hope with all my heart that you will carry it through to a fulfilment corresponding to the extraordinary fulfilment which you have achieved in all the other work you have undertaken in the development of your state, and with that wish and with thanks on behalf of our Association I would close with an invitation to you all to attend our meetings; and I would express particularly the hope that all of you who are interested in broad discussions and deep-thought views of scientific problems will take advantage of the opportunity to hear the address of our retiring President, which will be the central and most interesting event of our proceedings. With thanks, therefore, for your courtesy and kindness, and expression of pleasure on behalf of all the members of the Association who are here, I will now close my reply to the hospitable welcomes which have been made us.

The GENERAL SECRETARY read a resolution of the Council that members of the Local Committee, members of the affiliated societies, and residents of Denver and vicinity, should be admitted to Associate Membership for this meeting, on the usual terms.

The PERMANENT SECRETARY read the names of members and fellows of the Association deceased since the New York meeting and announced the arrangements which had been made for the sectional meetings and called attention to the provisions for the organization of Sections. After agreement on hours of meeting, as printed in the preliminary program, the General Session was declared adjourned.

An amendment to Article 18 of the Constitution, submitted at the New York meeting in 1900, was reported at general session from the council for favorable action and adopted. The amendment is as follows:

In Article 18, after the words 'The Treasurer of the current meeting,' omit 'with the addition,' and after the words 'by ballot on the first day of its meeting' insert 'of one fellow elected by each affiliated society and one additional fellow from each affiliated society having more than twenty-five members who are fellows of the Association.'

The following amendment to Article 20 of the Constitution was also adopted:

Add to the end of Article 20 the words, 'But if suitable preliminary arrangements cannot be made, the council may afterward change the

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time and place appointed by the general committee, if such change is believed advisable by two-thirds of the members present.'

The following amendments to the constitution were read before the council and at the general session and will be acted on at the next meeting:

In Article 9, after the words 'with the exception of the Permanent Secretary' omit 'and,' and after the words 'the Treasurer' insert 'and the Secretaries of the Sections'; and after the words 'The term of office of the Permanent Secretary' omit 'and,' and after the words 'the Treasurer' insert 'and of the Secretaries of the Sections.'

In Article 18, after the words 'who are fellows of the Association,' insert 'and of nine fellows elected by the Council, three being annually elected for a term of three years.'

In Article 23, after the words 'of a Section there shall be' omit 'three members or fellows' and insert 'a member or fellow,' and after the words 'Vice-President and Secretary of the preceding meeting' insert 'and the members or fellows elected by ballot at the four preceding meetings.'

Reports of standing and special committees were presented and their recommendations adopted as follows:

COMMITTEE ON THE POLICY OF THE ASSOCIATION.

The Committee on the Policy of the Association presents the following recommendations to the council in regard to certain matters which have been referred to it for consideration:

1. The Committee recommends that owing to the great increase of engineers in the membership of the Association, it would be inexpedient to consider the question of the discontinuance of Section D.

2. The Committee recommends that the proceedings of the annual meetings, including the addresses of the Vice-Presidents, the reports of committees and officers, and abstracts of all papers, be published immediately in *Science*, and further that the addresses of the Vice-Presidents, titles of all papers and reports of officers and committees, the Constitution and lists of officers, members and fellows, be published by the Permanent Secretary in a volume as soon thereafter as possible. The Committee further recommends that authors wishing to make alterations in abstracts of their papers shall do so before the close of the meeting and that abstracts shall not exceed 400 words in length. It further recommends that the Secretaries of Sections shall forward these abstracts with an account of the work of the meeting to the responsible editor of *Science* within a week after the close of the meeting.

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3. The Committee recommends that Section K organize at the present meeting by the formation of a Sectional Committee and that papers submitted for this Section at this meeting be referred in accordance with their character to Sections H or F.

[Signed] CHARLES S. MINOT,
R. S. WOODWARD.
L. O. HOWARD.

COMMITTEE ON THE RELATIONS OF THE JOURNAL, SCIENCE, WITH THE ASSOCIATION.*

This committee is able to report that the arrangement by which *Science* has this year been sent to the members of the Association has been satisfactory in every respect. It has been generally approved and has apparently strengthened the Association and the organization of science in America. The membership of the Association has greatly increased, the fees of new members sufficing to pay the entire expense of sending *Science* to all members of the Association. We recommend that we be authorized to renew for the year 1902 the present contract with the Macmillan Company. We also recommend that the Treasurer of the Association be added to this committee.

[Signed] SIMON NEWCOMB, *Chairman*,
R. S. WOODWARD,
L. O. HOWARD,
J. McK. CATTELL, *Secretary*.

COMMITTEE ON CONVOCATION WEEK.

The plan of setting aside the week in which New Year's Day falls as a convocation week for the meetings of scientific and learned societies has met with almost universal approval on the part both of societies and of institutions of learning. At the instance of this committee, the Association of American Universities passed unanimously a resolution recommending the establishment of a convocation week, and the thirteen universities composing the Association have with one exception either left the week entirely free from academic exercises, or will give all officers leave of absence. We have now begun correspondence with about fifty additional universities, colleges and technical schools.

In view of the favorable reception of the plan for a convocation week we recommend:

* Mr. G. K. Gilbert, the remaining member of this committee, was absent in the field and unable to sign this report, but it is known that he concurs in its recommendation.

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1. That this Association and its affiliated societies meet in Washington in the week in which New Year's Day of 1903 falls, without, however, committing ourselves at present to the abandonment of summer meetings.

2. That the Council meet in Chicago during the Convocation Week of 1901-2, and that the Sectional Committees may organize meetings of their respective Sections, the expenses of each of which shall not exceed $25, to be paid from funds in the hands of the Permanent Secretary.

3. That this Committee be continued.

[Signed] CHARLES S. MINOT,
R. S. WOODWARD,
EDW. L. NICHOLS,
L. O. HOWARD,
J. MCK. CATTELL.

NINETEENTH ANNUAL REPORT OF THE COMMITTEE ON INDEXING CHEMICAL LITERATURE.

The Committee on Indexing Chemical Literature, appointed by your body in 1882, respectfully presents its Nineteenth Annual report, embracing the fourteen months from June 1, 1900, to August 1, 1901.

WORKS PUBLISHED.

A Select Bibliography of Chemistry, 1492-1897. By HENRY CARRINGTON BOLTON. Section VIII, Academic Dissertations. City of Washington, published by the Smithsonian Institution. 1901. 8vo. Pp. vi + 534.

This forms No. 1253 of the Smithsonian Miscellaneous Collections, Vol. XLI.

This Bibliography of Academic Dissertations is a second part of the work published in 1893, and with the 'First Supplement,' issued in 1899, completes (if the term can be applied to bibliography) the undertaking begun by Dr. Bolton in 1888. The three volumes comprise about 25,000 titles. The dissertations found in the libraries of the Smithsonian Institution and of the U. S. Geological Survey are indicated by appropriate initials. There is a full subject-index.

The completed manuscript of a 'Bibliography of the Analytical Chemistry of Manganese,' by Professor Henry P. Talbot, and John W. Brown, has been carefully examined by your Committee, and they have recommended it for printing to the Smithsonian Institution to which it has been presented.

WORKS IN PROGRESS.

Mr. Frank R. Fraprie reports progress on his manuscript 'Index to

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the Literature of Caesium, Rubidium and Lithium,' which is to be completed within a twelve-month.

Mr. G. A. Smith, of Cornell University, reports that his 'Index to the Literature of Selenium and Tellurium' will be completed by the close of the academic year.

Dr. M. D. Sohon is preparing for the press a 'Subject-Index to the Journal of the American Chemical Society.'

Dr. H. Carrington Bolton has in preparation another 'Supplement to the Select Bibliography of Chemistry,' intended to cover the period beginning with 1897, and to include omissions.

Dr. Alfred Tuckerman has revised and prepared for the press the continuation of his 'Index to the Literature of the Spectroscope'; the MS. has been presented to the Smithsonian Institution.

NOTES.

During the past twelve months there have been published the following bibliographical works on chemical subjects:

Bibliographia Lactaria. Bibliographie générale des travaux parus sur le lait et l'llaitement jusqu'en 1899. Paris, 1900. 600 pp. 8vo.

Bulletin de la Société chimique de Paris. Tables des années 1899 a 1898, dressées par Th. Schneider. Paris, 1900. Two parts.

Zeitschrift fur physikalische Chemie, Stöchiometrie, und Verwandschaftslehre. Namen und Sach-Register über Band I.—XXV., bearbeitet von T. Paul, Leipzig, 1900. 8vo.

And Professor A. K. Krupsky, of St. Petersburg, announces a 62-page 'Bibliography of Chemistry' in Russian, which your committee is as yet unable to describe more accurately.

H. Carrington Bolton (in Europe),
F. W. Clarke,
A. R. Leeds,
A. B. Prescott,
Alfred Tuckerman,
H. W. Wiley,
Committee.

Committee on Anthropometric Measurements.

At the New York meeting of the Association physical and mental measurements were made of about forty fellows of the Association, under the auspices of this committee. The number is not sufficient to permit of the publication of the results, but some points of interest were disclosed. We are anxious to continue these measurements, but cannot do so at Denver owing to the difficulty of transporting instruments

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and securing skilled assistance. We hope to overcome the former difficulty in future by the construction of instruments that can be packed in a dress-suit traveling case. The sum of $50 appropriated last year for the committee has been used in constructing instruments with this object in view, a balance and measuring rod having been made that can be readily transported. A traveling set of instruments of this character would be of value in anthropological expeditions.

The members of the committee resident in New York have continued anthropometric work, measuring the mental and physical traits of students of Columbia and Barnard Colleges, and of children in the schools. A thesis has been accepted for the degree of doctor of philosophy in Columbia University by Mr. Clarke Wissler on the 'The Correlation of Mental and Physical Traits.' This thesis, which has been published as a supplement to the *Psychological Review,* is the first full treatment by quantitative methods of the interrelation of mental and physical traits. Professor E. W. Thorndike has also at Columbia University carried on experiments on the correlation of mental ability, which will shortly be published.

For the completion of the traveling set of anthropometric instruments referred to, the committee asks a further grant of fifty dollars.

[Signed] J. McK. CATTELL,
FRANZ BOAS,
W J McGEE

REPORT OF THE COMMITTEE ON THE QUANTITATIVE STUDY OF VARIATION.

The grant of one hundred dollars to this Committee was used to help defray the expenses of Mr. C. C. Adams, incurred in collecting for study molluscs of the genus *Io,* found in the headwaters of the Tennessee River. A preliminary report has been made by Mr. Adams, and this was printed in the *Proceedings* of the Association for 1900. Mr. Adams submits at this time a second report covering the results of study on the material collected last summer, but prefers to postpone further publication until after his final expedition, which he is making this summer. The main results so far are that he has shown by the aid of an elaborate series of measurements that the numerous species of *Io* run into each other in a very complete way, and that the differences between the shells are associated with their position up or down stream. Nevertheless there is in most streams a more or less marked discontinuity between the smooth, globular, up-stream shells and the spiny, elongated down-stream shells. The meaning of the discontinuity (which justifies, in a way, a division of the shells into two species) is still not perfectly clear. To test certain hypotheses in respect to this discontinuity, Mr. Adams has returned to the field this summer. This piece of work is, we believe,

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the largest and most thorough-going quantitative study of the variation of a species in nature that has yet been reported upon.

The committee requests the Council to grant it one hundred dollars additional, to aid Mr. Adams in this his final summer's work on this topic.

The Committee is glad to report an increasing interest in the quantitative study of variation, and especially the establishment by Professors Pearson and Weldon of a new journal—*Biometrica*—devoted to the results of such study.

[Signed] FRANZ BOAS, *Chairman*,
CHARLES S. MINOT,
J. McK. CATTELL,
C. H. EIGENMANN,
C. B. DAVENPORT, *Secretary*.

REPORT OF THE COMMITTEE ON THE RELATION OF PLANTS TO CLIMATE.

The investigations conducted under the guidance of the committee have been directed toward a study of the thermal relations of vegetation; an examination of the prevailing methods of meteorological observation in obtaining thermometric data has been made, and it is found that the data so obtained are incapable of direct application in the consideration of the seasonal development and distribution of plants.

As the result of two seasons of thermographic observation in the New York Botanical Garden and in the field in Montana and Idaho, a new method of calibration of the temperature exposures of plants has been formulated. This method is based upon a proposed hour degree-unit of temperature. Such unit of temperature may be defined as consisting in a departure of one degree Centigrade above or below zero for the period of one hour. The estimation of the number of such units affecting a plant in any given locality is obtained by the measurement of the areas enclosed by the thermographic curve above and below the zero line.

The number of such units of exposure to which the plants of two localities are subjected have already been estimated, and with incidental results will be presented to this Section at an early session. Thus, for instance, a meadow carpet in the New York Botanical Garden received 78,836 hour-degrees of heat during the year ending April 1, 1901, while the carpet in an adjacent hemlock forest received 68,596 hour-degrees of heat during the same period.

It is believed that the method of procedure outlined above will afford an exact method of dealing with the relation of plants to the temperatures of their environment, but it will be necessary to extend the obser-

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vations over a number of years in the same locality in order to establish its usefulness and define incidental amendments.

The work involved in such observation entails constant observation by means of thermograph and much time in the calibration of thermographic curves.

Your committee asks a further grant of $50 for the furtherance of this work, it being proposed that the sum named should be expended in clerical and mechanical assistance. A further sum of $10 is asked for the repair of a thermograph wrecked in some recent field work in this connection, making a request for a total grant of $60.

The following items of expenditure are presented against the grant of $50 made by the Association to this committee at the meeting of 1900.

To freight charges on outfit from New York to Priest River, Idaho	$24.86
To hauling same to camp on Priest River, to Priest Lake and return	25.00
To making temporary instrument shelters (partial account)	.14
Total	$50.00

[Signed] WM. TRELEASE,
JOHN M. COULTER,
D. T. MCDOUGAL,
Committee.

REPORT OF THE COMMITTEE ON THE TEACHING OF ANTHROPOLOGY IN AMERICA.

To the Council of the American Association for the Advancement of Science.

GENTLEMEN:

Your committee beg to report careful consideration of the matter committed to them. Two meetings have been held since the last report, and one of the committee (Dr. George Grant McCurdy) has, by authority, prepared an account of anthropologic teaching in America during the past year to be presented as a paper before Section H. It is recommended that the committee be continued and empowered to issue circulars relating to the introduction of anthropology in American universities and colleges, *provided* such circulars have the approval of the Permanent Secretary and be issued without cost to the Association.

[Signed] W J MCGEE, *Chairman,*
GEORGE GRANT MACCURDY,
FRANK RUSSELL.

August 27, 1901.

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COMMITTEE ON THE 'EMMONS HOUSE MEMORIAL.

The American Association for the Advancement of Science was organized in 1847. It was the organic descendant and enlarged outgrowth from the Association of American Geologists and Naturalists. The latter body was created in 1842 by the incorporation of the Naturalists within the Association of American Geologists. The Association of American Geologists is therefore to be looked upon as the legitimate organic ancestor of the American Association for the Advancement of Science.

The circumstances which led up to the organization of the Association of American Geologists are as follows:

During the prosecution of the Geological Survey of the State of New York the need of the Geologists for consultation and interchange of view with others engaged in official geologic work led to the suggestion of an organization of a body of American Geologists. It appears that Lieutenant W. W. Mather, one of the New York Geologists, suggested the subject of such a meeting to the Board of Geologists in November, 1838. He wrote:

Would it not be well to suggest the propriety of a meeting of the geologists and other scientific men of our country at some central point next fall, say in New York or Philadelphia? There are many questions in our geology that will receive new light from friendly discussion and the combined observation of various individuals who have noted them in different parts of our country. Such a meeting has been suggested by Professor Hitchcock and to me it seems desirable. It would undoubtedly be an advantage not only to science, but to the several surveys that are now in progress and that may in future be organized. It would tend to make known our scientific men to each other personally, give them more confidence in each other and cause them to concentrate their observations on those questions that are of interest either in a scientific or economical point of view. More questions may be satisfactorily settled in a day by oral discussion in such a body than in a year by writing and publication. (Letter from W. W. Mather to the Geological Board of New York, dated November 9, 1838, and addressed to Professor Emmons.)

It appears herein that the suggestion of this meeting was originally made by President Edward Hitchcock, of Massachusetts, who was the first to receive the appointment as geologist of the First District of New York from Governor Marcy. President Hitchcock has said in regard to the suggestion made by Lieutenant Mather: "As to the credit he has here given me of having previously suggested the subject I can say only that I had been in the habit for several years of making this meeting of scientific men a sort of hobby in my correspondence with such." (Address of President Edward Hitchcock at the inauguration of Geological

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Hall, at Albany, August 27, 1856. Tenth annual report New York State Cabinet of Natural History, 1857, page 23.)

Lieutenant Mather's letter to the Board of Geologists was taken up for consideration at a meeting held November 20, 1838, at the house of Dr. Ebenezer Emmons, corner of High street and Hudson avenue, Albany. (See documents herewith appended being A, a statement dictated by Professor James Hall, August 24, 1896, and B, a statement dictated by Ebenezer Emmons, Jr., February, 1900.) The action taken by the geologists was one of unanimous approval of the proposition, and Lardner Vanuxem of the Third District was commissioned to open communication with other geologists, especially with President Hitchcock, with reference to carrying this project into effect.

The undertaking was not immediately successful and at a meeting held in the autumn of 1839 the purposes of the geological board were reiterated. This meeting was also held at Dr. Emmons' house, the four geologists and the paleontologist being present, and also Ebenezer Emmons, Jr., who still survives. As a result of the second undertaking on the part of the New York geologists a meeting was called in Philadelphia for April, 1840, where and when the organization of the Association of American Geologists was carried into effect. The following year the Association again met in Philadelphia, at which time the membership of the body was largely increased, and in 1842 the place of meeting was Boston and then, as already rehearsed, the name and the scope of the Association were, at the solicitation of the naturalists, both enlarged. President Hitchcock, addressing the New York public interested in the outcome of the work of their geologists, makes the following statement in the address already quoted:

It may be thought that the New York geologists in their invitation and the members of that first Philadelphia meeting had no thought of extending their Association beyond geologists; but Professor Mather's language just quoted speaks of 'a meeting of the geologists and other scientific men of our country,' thus showing what were his aspirations, and they were shared by all of us who had anything to do with that first meeting. But we knew that only a short time previous the American Academy of Arts and Sciences at Boston had directed a request to the American Philosophical Society as the oldest of the kind in the country, that it would invite the scientific men of the land to such a meeting as the one we are now enjoying; but the distinguished men of that Society decline through fear that the effort would prove a failure. Surely then it did not become us to announce any such intentions or expectations; yet we did talk of them and could not but hope that what might fail if attempted on a large scale at first might be accomplished step by step. *Had not the New York geologists issued that modest invitation and confined it at first to the State surveyors probably even yet*

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we might have been without an Association for the Advancement of Science. (President Hitchcock's address, ut. cit.)

The committee appointed by this Association to consider the matter of placing a memorial tablet upon the Emmons' house in Albany, N. Y., begs to submit the foregoing as evidence of the prenatal history of the American Association and to recommend that this house, the home of the late Ebenezer Emmons, a man of eminence in his profession, of untiring diligence and enduring patience, be permanently marked by a tablet setting forth the interest of that spot to the history of the Association. It is suggested that such tablet bear the following inscription:

In this house, the home of
Dr. EBENEZER EMMONS
the first formal efforts were made, in
1838 and 1839, toward the organization of the
ASSOCIATION OF AMERICAN GEOLOGISTS
the parent body of the
American Association for the Advancement of
Science
by whose authority this tablet is erected
1901

The committee further reports that the cost of this tablet will constitute no claim upon the treasury of the Association, but will be borne individually by one of its members, Dr. T. Guilford Smith.

JOHN M. CLARKE,
C. H. HITCHCOCK,
J. McK. CATTELL,
W J McGEE.

A. Statement dictated to John M. Clarke, by Professor James Hall, August 24, 1896.

The organization of a body of American Geologists was proposed by the four geologists at Dr. Emmons' house at the corner of Hudson avenue and High street. It was during the fall of 1838. Vanuxem was asked to see or communicate with the Rogerses concerning it, but nothing came of it that year. The next year we reiterated our purpose as the intention was to get some means of comparing our results with those of other geologists in other States, especially in Pennsylvania. This meeting was held at Dr. Emmons' house, the four geologists being present and perhaps also Conrad. Ebenezer Emmons, Jr., was also there. We then decided to communicate again with the Rogerses and others for the end already suggested and to organize a Society of

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Geologists for this especial purpose. We wanted to compare our results with those of others and make up our nomenclature, and we had to do it soon, as we were required to publish. As a result of this unanimously expressed purpose a meeting was called for April, 1840, in Philadelphia. I was present then but not at the second Philadelphia meeting in 1841, as that year I was off in May and June with D. D. Owen on a flat boat sailing down the Ohio, sleeping on a box and collecting fossils all along from Louisville to New Harmony. As far as Rogers was concerned the meeting came to naught. He was not ready with his results and gave them only at the third meeting at Boston in 1842. It was here that the Naturalists proposed to join us and we agreed thereto, but the Boston meeting was called as the meeting of the Association of American Geologists and in the course of that meeting the name was changed to that of Association of American Geologists and Naturalists.

B. Statement dictated to John M. Clarke by Ebenezer Emmons, Jr., February, 1900.

I was present at the meeting of the four geologists at my father's house, in 1838. I was then about 16 years old, and had assisted my father in his field work and making drawings and sketches. Mr. Conrad, the paleontologist, was also present. I recollect that the board of geologists then authorized Mr. Vanuxem to open correspondence with others for the purpose of effecting an organization.

COMMMITTEE ON GRANTS.

The following grants are recommended:

1. To Committee on Quantitative Study of Biological Variation, $100.
2. To Committee on Relation of Plants to Climate, $60.
3. To Committee on Anthropometric Measurements, $50.
4. To Committee on Determination of Atomic Weight of Thorium, $50.

[Signed] R. S. WOODWARD,
Chairman.

The recommendation of the general committee of last year that the Association meet at Pittsburg in the summer of 1902, was supplemented by Dr. W. J. Holland, Director of the Carnegie Museum, and it was decided to meet at Pittsburg from June 28 to July 3, inclusive, 1902.

The general committee recommended also that a meeting be held in Washington, D. C., during 'Convocation week,' or the week in which the first of January falls, in 1903.

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Professor Wm. Trelease and C. M. Woodward presented an invitation to the Association to meet in St. Louis during the time of the Louisiana Purchase Exposition in 1903. This invitation was referred, without formal recommendation, to the general committee of 1902.

JOHN M. COULTER,
General Secretary.

REPORT OF THE PERMANENT SECRETARY.

The fiftieth annual meeting of the A. A. A. S., which will be known in the future as the 'Denver Meeting,' or possibly, and let us hope, as the '*first* Denver Meeting,' has been a most successful one. There have been in attendance 306 members and associates, making the meeting in this regard rank as the 22d largest meeting. What may be termed the geographic distribution of the members in attendance has been interesting. From the Atlantic Coast region there have been 92, or nearly one-third, from the Pacific Coast 11, and from foreign countries 6, leaving two-thirds from the great interior of the country.

The distribution by States has been as follows:

Colorado heads the list with	79
New York	30
District of Columbia	28
Iowa	15
Missouri	14
Massachusetts	13
Pennsylvania, Illinois	12 ea.
Kansas	11
California	10
Nebraska	9
Indiana	8
Wisconsin	7
Minnesota, Ohio, Connecticut, New Mexico	5 ea.
Wyoming, Canada, Michigan	4 ea.
Texas	3
West Virginia, Montana, Arizona	2 ea.
Georgia, North Dakota, South Dakota, Oregon, Nevado, Oklahoma, New Hampshire, Tennessee, New Jersey, North Carolina, Arkansas, Louisiana, England, Ireland	1 ea.

It must be borne in mind, however, that the number registered, 306, includes only the actual members and associates of the A. A. A. S., and that the great national affiliated societies of specific aim which have

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met with us have drawn many more scientific men and women to Denver within the past week, so that it has really been a scientific congress of much importance.

The papers which have been read before the Association proper and in joint sessions with the more closely affiliated societies have been numerous and of a high order. About 220 in all have been presented.

A number of important measures concerning the future of the Association have been considered. An amendment to the constitution providing for the representation in the Council of the affiliated societies seems one of the most important steps taken by the Association of recent years, while other amendments looking towards a more stable membership in the Council have been introduced and will be considered later.

About 50 new members have been elected during the meeting; and 186 members have been made fellows.

Denver and its vicinity have provided visiting points of great scientific interest, and the facts just stated, together with the great courtesy and warm-hearted hospitality of the citizens of Denver, have combined to make the meeting now coming to a close a memorable one in the annals of the Association.

The following is a comparative statement of the roll as printed in the Boston and Columbus volumes and in the present volume:

	Columbus.	New York.	Denver.
Surviving founders,	6	3	3
Living patrons,	2	2	2
Living honorary fellows,	2	2	2
Fellows,	788	862	1054
Members,	897	1052	1904
Totals,	1695	1921	2965
Honorary life fellows (founders) included in the above,	6		3

The financial report of the permanent secretary will follow that of the treasurer.

L. O. HOWARD, Permanent Secretary.

REPORT OF THE TREASURER.

In compliance with Article 15 of the Constitution, and by direction of the Council, I have the honor to submit the following report, showing receipts, disbursements, and disposition of the funds of the Association for the year ending December 31, 1900.

Receipts have come into the keeping of the Treasurer from four

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sources, namely: First, from commutations of fees of life-members of the Association; secondly, from excess of receipts over expenditures of the Permanent Secretary; thirdly, from a contribution to the Association by Mrs. Phoebe Thorne, of New York City; and fourthly, from interest on funds deposited in savings banks. The aggregate of these receipts is $1,805.07.

Disbursements made in accordance with the directions of the Council amount to $283.00.

The total amount of funds of the Association deposited in banks and subject to the order of the treasurer, December 31, 1900, is $10,189.18.

The details of receipts, disbursements, and disposition of funds are shown in the following itemized statement.

Dated June 1, 1901.

THE TREASURER IN ACCOUNT WITH THE AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE.

1900.	Dr.		
January 1,	To balance from last account - -		$ 8667 11
October 20,	To amount received from L. O. Howard for 5 life-membership commutations - -		250 00
October 20,	To amount transferred from funds of L. O. Howard, Permanent Secretary, -		1000 00
December 14,	To contribution to the Association received from Mrs. Phoebe Thorne - -		250 00
December 31,	To interest on funds of the Association deposited in Savings banks, as follows:		
	From Cambridge Savings Bank, Cambridge, Mass., - - -	$35 70	
	From Emigrant Industrial Savings Bank, New York, N. Y., - -	82 88	
	From Institution for the Savings of Merchants' Clerks, New York, N. Y., -	99 55	
	From Metropolitan Savings Bank, New York, N. Y., - - -	86 94	
			305 07
	Total - - - -		$10472 18

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1900.	Cr.		
February 6,	By cash paid Professor C. H. Eigenmann, of Committee on study of blind vertebrates		$ 100 00
June 29,	By cash paid Dr. D. T. MacDougal of Committee on study of the relations of plants to climate - - - - - -		33 00
August 6,	By cash paid Professor Charles B. Davenport of Committee on quantitative study of biological variation - - - - -		150 00
December 31	By cash on deposit in banks as follows:		
	In Cambridge Savings Bank, Cambridge, Mass - - -	$ 1047 36	
	In Emigrant Industrial Savings Bank, New York, N. Y., - -	3030 85	
	In Institution for the Savings of Merchants' Clerks, New York, N. Y.,	2818 97	
	In Metropolitan Savings Bank, New York, N. Y., - - -	2889 80	
	In the Fifth Avenue Bank of New York, N. Y., - - -	402 20	
			10189 18
	Total - - - - -		$10472 18

I have examined the foregoing account and certify that it is correctly cast and properly vouched.

EMORY MCCLINTOCK, *Auditor.*

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L. O. HOWARD, PERMANENT SECRETARY, IN
TION FOR THE ADVANCE-
From January 1, 1900, to

DR.

To balance from last account, - - -		$ 4228 33
Admission fees previous to New York meeting,	$ 15 00	
Admission fees New York meeting, -	1275 00	
Assessments for 1901, - - - -	76 00	
Assessments for 1900, - - -	4730 00	
Assessments for previous years, - -	1244 00	
Associate fees, - - - -	84 00	
Life membership fees, - - - -	300 00	
Fellowship fees, - - - -	134 00	
		7858 00
Publications and bindings, - - -	194 80	
Interest, - - - - -	30 61	
Miscellaneous receipts, - - -	9 86	
		235 27
		$12321 60

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ACCOUNT WITH THE AMERICAN ASSOCIAMENT OF SCIENCE.

December 31, 1900.

Cr.

By publications.

Vol. 48,	$ 1131 45	
Binding,	94 55	
Separates of addresses,	74 01	
Columbus pamphlet,	109.85	
Illustrations, Vols. 48 and 49,	58 01	
Index, Vols. 48 and 49,	24 25	
		1492 12

By expenses New York meeting.

Daily program,	600 00	
Preliminary announcements, sectional programs, etc.,	101 78	
Messengers, typewriters, placards, blanks, badges, etc.,	94 16	
Accounts of Secretaries of sections, and Gen. Sec.,	322 05	
General expenses,	107 11	
		1225 10

By general office expenses.

Circulars, tickets, blank forms, letter heads, etc.,	155 75	
Postage,	350 93	
Express,	318 41	
Extra clerical help, typewriting, etc.,	26 37	
Telegrams, check book and miscellaneous small expenses,	29 65	
		881 11

By salaries.

Permanent Secretary,	1250 00	
Assistant Secretary,	720 00	
		1970 00

By spreading information in order to increase membership by order of Council.

Postage,	105 90	
Circulars and blank forms,	82 23	
Typewriting, addressing envelopes, etc.,	110 50	
		298 63

By miscellaneous expenses.

Storage on back volumes,	154 50	
Moving same to New York for free storage,	204 13	

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Moving office effects, North Andover to Washington,	27 73	
Grant to committee (order of council),	17 00	
Overpaid dues returned,	9 50	
Cash paid Treasurer,	1300 00	
		1712 88
By balance to new account,		4741 76
		$12321 60

I hereby certify that I have examined this account and that it is correctly cast and properly vouched for, and that the balance was on deposit in Washington banks as follows: Citizens National (as per statement January 8, 1901), $3229.62; National Safe Deposit (including interest credited January 1, 1901), $519.43; American Security and Trust (including interest credited January 7, 1901), $1034.58; in all, $4783.63.

G. K. GILBERT, *Auditor.*

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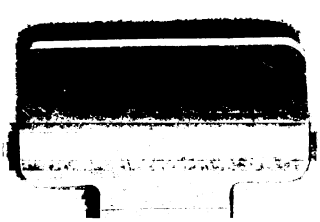

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